CAREER LAUNCHER SERIES

ELECTRICAL ENGINEERING
(OBJECTIVE QUESTIONS)

FOR SSC-JE/PSU/GATE/ESE EXAMS
OVER 4000 MCQs

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By AP Experts

A team of scholars and retired faculty from IIR, Roorkee

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Every chapter contains:

- **Warm Up Questions**
- **Questions from SSC-JE/PSU exams**
- **Questions from ESE (formerly IES) exams**
- **Questions from GATE exams**

BASIC CONCEPTS & NETWORK THEOREMS

WARM-UP QUESTIONS

1. Identify the passive elements among the following.
(a) Voltage source
(b) Current source
(c) Inductor*
(d) Transistor

2. Determine the total inductance of a parallel combination of 100 mH, 50 mH and 10 mH.
(a) 7.69 mH*
(b) 160 mH
(c) 60 mH
(d) 110 mH

3. If the voltage across a given capacitor is increased, the amount of stored charge
(a) increases*
(b) decreases
(c) remains same
(d) is exactly doubled

4. How much energy is stored by a 100 mH inductance with a current of 1 A?
(a) 100 J
(b) 1 J
(c) 0.05 J*
(d) 0.01 J

5. The following voltage drops are measured across each of three resistors in series 5.2 V, 8.5 V and 12.3 V. What is the value of the source voltage to which these resistors are connected?
(a) 8.2 V
(b) 12.3 V
(c) 5.2 V
(d) 26 V*

6. A certain series circuit has 100 Ω, 270 Ω and 330 Ω resistors in series. If the 270 W resistor is removed, the current will
(a) increase*
(b) become zero
(c) decrease
(d) remain constant

7. A series circuit consists of a 4.7 kΩ, 5.6 kΩ, 9 kΩ and 10 kΩ resistors. Which resistor has the highest voltage across it?
(a) 4.7 kW
(b) 5.6 kW
(c) 9 kW
(d) 10 kW*

8. The total power in a series circuit is 10 W. There are five equal value resistors in the circuit. How much power does each resistor dissipate?
(a) 10 W
(b) 5 W
(c) 2 W*
(d) 1 W

9. When a 1.2 kΩ resistor, 100 Ω resistor, 1 kΩ resistor and 50 Ω resistor are in parallel, the total resistance is less than
(a) 100 Ω
(b) 50 Ω*
(c) 1.2 kΩ
(d) 1 kΩ

10. If one of the resistors in a parallel circuit is removed, what happens to the total resistance?
(a) Decreases
(b) Increases*
(c) Exactly doubles
(d) Remains constant

11. Six light bulbs are connected in parallel across 110 V. Each bulb is rated at 75 W. How much current flows through each bulb?
(a) 0.682 A*
(b) 0.7 A
(c) 75 A
(d) 110 A

12. Superposition theorem is valid only for
(a) linear circuits*

(b) non-linear circuits
(c) both(a) and(b)
(d) neither(a) nor(b)

13. When superposition theorem is applied to any circuit, the dependent voltage source is always
(a) opened
(b) shorted
(c) active*
(d) none of the above

14. Maximum power is transferred when the load resistance is
(a) equal to source in resistance*
(b) equal to half of the source resistance
(c) equal to zero
(d) none of the above

15. The superposition theorem is not valid for
(a) voltage responses
(b) current responses
(c) power responses*
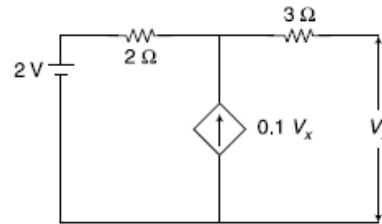(d) all the above

16. Determine the current I in the circuit
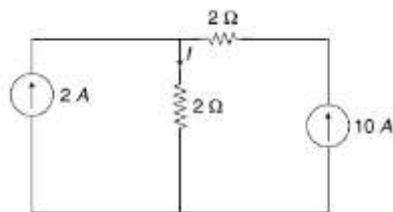
(a) 2.5 A
(b) 1 A
(c) 12 A*
(d) 4.5 A

17. The reciprocity theorem is applicable to
(a) linear networks only
(b) bilateral networks only
(c) both(a) and(b) *
(d) neither(a) nor(b)

18. Thevenin voltage in the circuit shown in figure is
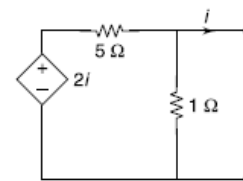

(a) 3V
(b) 2.5 V*
(c) 2 V
(d) 0.1 V

19. Three equal resistances of 3 Ω are connected in star what is the resistance in one of the arms in an equivalent delta circuit?
(a) 10 Ω
(b) 3 Ω
(c) 9 Ω*
(d) 27 Ω

20. Three equal resistances of 5 Ω are connected in delta. What is the resistance in one of the arms of the equivalent star circuit?
(a) 5 Ω
(b) 1.67 Ω*
(c) 10 Ω
(d) 15 Ω

21. Norton's current in the circuit is given by


(a) (2i/5) *
(b) zero
(c) infinite
(d) none

22. The nodal method of circuit analysis is based on
(a) KVL and Ohm's law
(b) KCL and Ohm's law*
(c) KVL and KCL
(d) both(a) and(b)

23. A practical voltage source consists of an ideal voltage source in
(a) series with an internal resistance*
(b) parallel with an internal resistance
(c) both(a) and(b)
(d) neither(a) nor(b)

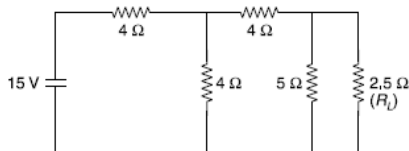24. Find the voltage between A and B in a voltage divider network
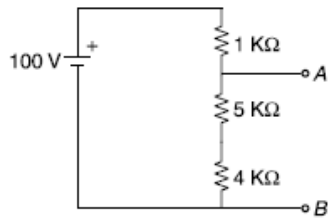
(a) 90 V*
(b) 9 V
(c) 100 V
(d) 0 V

25. The algebraic sum of all the currents meeting a junction is equal to
(a) 1
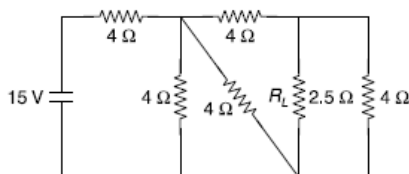(b) –1
(c) zero*
(d) can't say

26. Norton's equivalent current of the circuit in figure is

(a) 1.67 A
(b) 2.5 A
(c) 2 A
(d) 1.25 A*

27. Norton's equivalent current of the circuit in is

(a) 1.875 A
(b) 0.9375 A*

(c) 2 A
(d) 1 A

28. Which one of the following can be applied to analyse communication networks?
(a) Thevenin's Theorem
(b) Norton's Theorem
(c) Superposition Theorem
(d) Maximum-power Transfer Theorem*

29. Thevenin's Theorem cannot he applied to a network whist contains
(a) resistors
(b) linear impedance
(c) non-linear impedance*
(d) none of these

30. Superposition Theorem is valid for
(a) non-linear bilateral network
(b) linear bilateral network*
(c) non-linear unilateral network
(d) linear unilateral network

31. The equivalent voltage source of the current source as shown in figure is
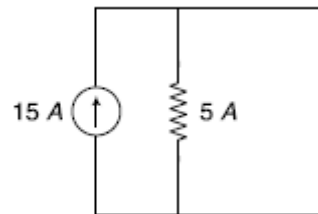
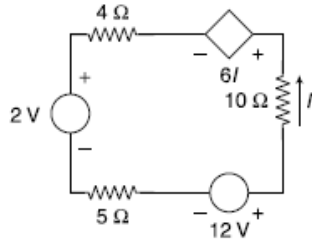

(a) 3 V
(b) 75 V*
(c) (3/5) V
(d) 5 Volt

32. A resistor is a/an
(a) non-linear element
(b) active element
(c) Unilateral element
(d) none of these*

33. The current flowing through the resistors of 10 Ω, 20 Ω, and 30 Ω connected in series is 2 A. The circuit is connected across a dc supply of
(a) 240 V
(b) 60 V

(c) 120 V*
(d) 30 V

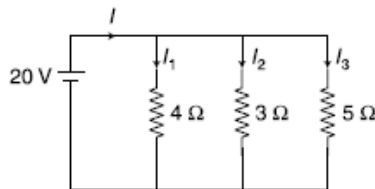34. The value of the current I in the single-loop circuit of figure is

(a) 2/5 A*
(b) 7/25 A
(c) 3 A
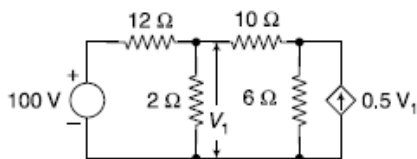(d) 9/16 A

35. Efficiency of maximum power transfer is
(a) 100%
(b) 50% *
(c) 25%
(d) 10%

36. The power dissipated across the 3 Ω resistor of figure is

(a) 133.33 W*
(b) 93.29 W
(c) 127.6 W
(d) 146.91 W

37. The value of V₁ of the circuit in figure is
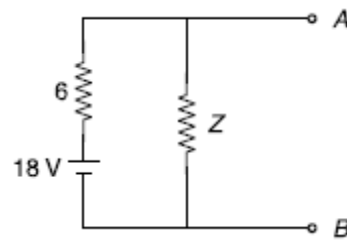

(a) 10.6 V
(b) 18.2 V*
(c) 16.7 V
(d) 21.13 V

38. The unit of energy is the

(a) ampere
(b) volt
(c) watt
(d) joule*

39. According to KVL, the algebraic sum of all IR drops and emfs in any closed loop of a network is always.
(a) zero*
(b) positive
(c) negative
(d) determined by battery emf

40. The load resistance needed to extract maximum power from the circuit of figure is

(a) 2 Ω*
(b) 9 Ω
(c) 6 Ω
(d) 18 Ω

41. A 12 Volt source with an internal resistance of 1.2 Ω is connected across a wire resistor. Maximum power will be dissipated in the resistor when its resistance is equal to
(a) zero
(b) 1.2 W*
(c) 12 W
(d) infinity

42. Which of the following elements is unilateral?
(a) Diode*
(b) Resistor
(c) Capacitor
(d) Inductor

43. Two 6 V, 2 Ω batteries are connected in series. This combination can be replaced by a single equivalent current generator with a parallel resistance of
(a) 3 A, 4 Ω *

(b) 3 A, 2 Ω
(c) 3 A, 1 Ω
(d) 6 A, 2 Ω

44. If two identical 3 A, 4 Ω Norton equivalent circuits are connected in parallel with like polarity to like, the combined Norton equivalent circuit is
(a) 6 A, 4 Ω
(b) 6 A, 2 Ω*
(c) 3 A, 2 Ω
(d) 6 A, 8 Ω

45. Two capacitances having 20F and 5F capacitances are connected in series. Their equivalent capacitance is
(a) 5 F
(b) 20 F
(c) 25 F
(d) 4 F*

46. Kirchhoff's voltage law is concerned with
(a) IR drops
(b) battery emfs
(c) junction voltages
(d) both(a) and(b) *

47. A good electric conductor is one that
(a) has low conductance
(b) is always made of copper wire
(c) produces a minimum voltage drop*
(d) has few free electrons

48. Which of the following material has nearly zero temperature coefficient of resistance?
(a) Carbon
(b) Porcelain
(c) Copper
(d) Manganin*

49. The positive terminal of a 6 V battery is connected to the negative terminal of a 12 V battery whose positive terminal is grounded. The potential at that negative terminal of the 6 V battery is
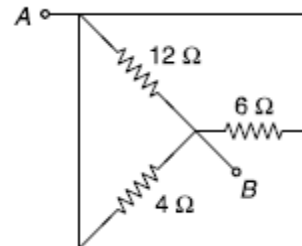(a) + 6 V
(b) –6 V
(c) –18 V*

(d) +18 V

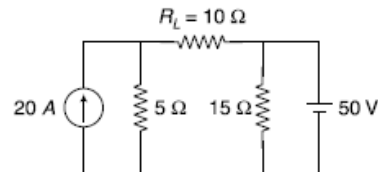50. In the above question, the potential at the positive terminal of the 6 V battery is _____ volt
(a) +6
(b) –6
(c) –12*
(d) +12

51. What is the equivalent resistance in Ω between points. A and B of figure
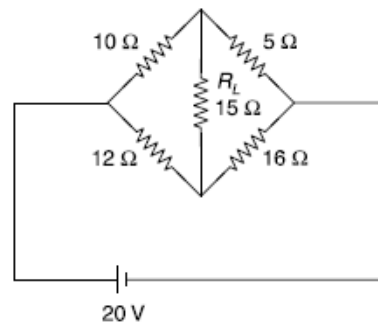

(a) 12
(b) 14.4
(c) 22
(d) 2*

52. In the circuit shown in figure,

Thevenin's equivalents voltage is
(a) 50 V*
(b) 100 V
(c) 10 V
(d) 150 V

53. Thevenin's equivalent resistance for circuit shown in figure is

(a) 0 Ω

(b) 10.2 Ω*
(c) 20 Ω
(d) 300 Ω

54. How many electrons pass a given point in a conductor in 10 s if the current strength is 18 A?
(a) 1.6×10^{-19}
(b) 18×10^{19}
(c) 112.5×10^{19}*
(d) 1800×10^{11}

55. Delta-star conversion of each equal resistances in each branch leads to
(a) decrease of resistance*
(b) increase of resistance
(c) same resistances
(d) none of these

56. Tesla is the unit of
(a) magnetic flux
(b) magnetic flux density*
(c) reluctance
(d) flux intensity

57. One radian is equal to
(a) $\pi°$
(b) 180°
(c) $\pi^0/180^0$*
(d) $180/\pi^0$

58. The unit of conductance is
(a) Coulomb
(b) Siemens*
(c) Farad
(d) Henry

59. In an electrical circuit, the base voltage is 4 kV while the base current is 100 amp. The base power would be
(a) 25 KVA
(b) 400 KVA*
(c) 40 KVA
(d) 250 VA

60. When the current comes out from the +ve polarity of the device, the current is called
(a) +ve Current*
(b) –ve Current

(c) zero sequence Current
(d) none of these

61. A conductor has a cross-sectional area of 3 mm^2 while the length is 100 m. If the conductor offers 8 Ω resistance, the conductivity of the material is
(a) 2.5×10^6 Siemens/m
(b) 9.2×10^6 Siemens/m
(c) 4.17×10^6 Siemens/m*
(d) 6.19×10^6 Siemens/m

62. A charge of 100 C passes through a conductor in 20 seconds. What is the corresponding current in amperes?
(a) 5 A*
(b) 2.5 A
(c) 10 A
(d) 7.5 A

63. If the length of a wire of resistance R is uniformly stretched to n times its original value, its new resistance is
(a) nR
(b) R/n
(c) n^2R*
(d) R/n^2

64. Two wires A and B of the same material and length L and 2L have radius r and 2r respectively. The ratio of their specific resistance will be
(a) 1 : 1
(b) 1 : 2*
(c) 1 : 4
(d) 1 : 8

65. A length of wire having a resistance of 1W is cut into four equal parts and these four parts are bundled together side by side to form a wire. The new resistance will be
(a) 1/4
(b) 1/16*
(c) 4 W
(d) 16 W

66. The hot resistance of the filament of a bulb is higher than the cold resistance because the temperature coefficient of the filament is
(a) negative

(b) infinite
(c) zero
(d) positive*

67. A network contains linear resistors and ideal voltage sources. If values of all the resistors are doubled then the voltage across each resistor is
(a) halved
(b) doubled
(c) increased by four times
(d) not changed*

68. A 10 V battery with an internal resistance of 1 Ω is connected across a nonlinear load whose VI characteristic is given by $7 I = V^2 + 2V$. The current delivered by the battery is
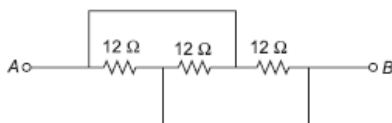(a) 0
(b) 10 A
(c) 5 A*
(d) 8 A

69. All the resistors in figure are 1 Ω each. The value of I will be
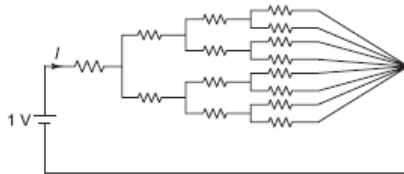
(a) 1/15 A
(b) 2/15 A
(c) 4/15 A
(d) 8/15 A*

70. For the circuit shown in Fig. 1.42, the equivalent resistance will be


(a) 36 Ω
(b) 12 Ω
(c) 6 Ω
(d) 4 Ω*

71. Two incandescent light bulbs of 40 W and 60 W rating are connected in series across the mains. Then

(a) the bulbs together consume 100W
(b) the bulbs together consume 50W
(c) the 60 W bulb glows brighter
(d) the 40 W bulb glows brighter*

72. Twelve 1 Ω resistors are used as edges to form a cube. The resistance between the two diagonally opposite corners of the cube is
(a) 5/6 Ω*
(b) 1 Ω
(c) 6/5 Ω
(d) 3/2 Ω

73. All resistors in the circuit shown in figure are of R Ω each. The switch is initially open. When the switch is closed the lamp's intensity
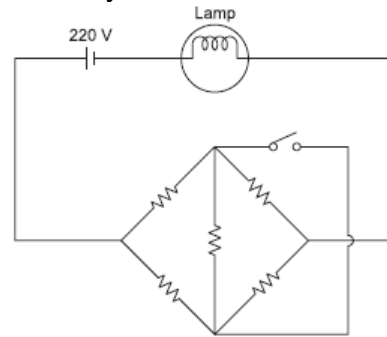
(a) increases
(b) decreases
(c) remains the same*
(d) depends on the value of R

74. Two 2 kW, 2 Ω resistors are connected in parallel. Then combined resistance and wattage ratings will be
(a) 4 kΩ, 4 W
(b) 1 kΩ, 4 W*
(c) 1 kΩ, 2 W
(d) 1 kΩ, 1 W

75. The nodal method of circuit analysis is based on
(a) KVL and Ohm's law
(b) KCL and Ohm's law*
(c) KCL and KVL
(d) KCL, KVL and Ohm's law

76. A network contains only an independent current source and resistors. If the values of all resistors are doubled, the value of the node voltages will
(a) become half
(b) remain unchanged
(c) become double*
(d) none of these

77. Superposition theorem is not applicable to networks containing
(a) nonlinear elements
(b) dependent voltage source
(c) dependent current source
(d) transformers*

78. Kirchhoff's current law is applicable to only
(a) closed loops in a network
(b) electronic circuits
(c) junctions in a network*
(d) electric circuits.

79. Kirchhoff's voltage law is concerned with
(a) IR drops
(b) battery e.m.f.
(c) junction voltages
(d) both(a) and(b) *

80. According to KVL, the algebraic sum of all IR drops and e.m.f.s in any closed loop of a network is always
(a) zero*
(b) positive
(c) negative
(d) determined by battery e.m.f.s.

81. The algebraic sign of an IR drop is primarily dependent upon the
(a) amount of current flowing through it
(b) value of R
(c) direction of current flow*
(d) battery connection.

82. Maxwell's loop current method of solving electrical networks
(a) uses branch currents
(b) utilizes Kirchhoff's voltage law*
(c) is confined to single-loop circuits
(d) is a network reduction method.

83. Point out of the WRONG statement. In the node-voltage technique of solving networks, choice of a reference node does not
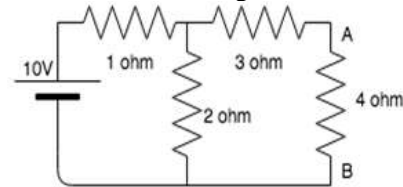(a) affect the operation of the circuit
(b) change the voltage across any element
(c) alter the p.d. between any pair of nodes
(d) affect the voltages of various nodes. *

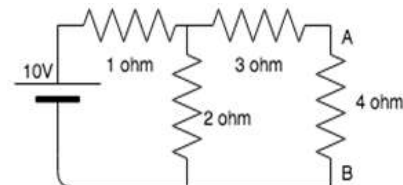84. Calculate the Thevenin resistance across the terminal AB for the following circuit.
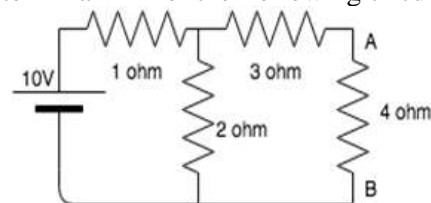
(a) 4.34 ohm
(b) 3.67 ohm*
(c) 3.43 ohm
(d) 2.32 ohm

85. Calculate V_{th} for the given circuit.

(a) 5.54V
(b) 3.33V
(c) 6.67V*
(d) 3.67V

86. Calculate the current across the 4 ohm resistor.

(a) 0.86A*
(b) 1.23A
(c) 2.22A
(d) 0.67A

87. The Thevenin voltage is the ——

(a) Open circuit voltage*
(b) Short circuit voltage
(c) Open circuit and short circuit voltage
(d) Neither open circuit nor short circuit voltage

88. Thevenin resistance is found by ——
(a) Shorting all voltage sources
(b) Opening all current sources
(c) Shorting all voltage sources and opening all current sources*
(d) Opening all voltage sources and shorting all current sources

89. Thevenin's theorem is true for ——
(a) Linear networks*
(b) Non-Linear networks
(c) Both linear networks and nonlinear networks
(d) Neither linear networks nor non- linear networks

90. In Thevenin's theorem V_{th} is ——
(a) Sum of two voltage sources*
(b) A single voltage source
(c) Infinite voltage sources
(d) 0

91. V_{th} is found across the —— terminals of the network.
(a) Input
(b) Output*
(c) Neither input nor output
(d) Either input or output

92. Which of the following is also known as the dual of Thevenin's theorem?
(a) Norton's theorem*
(b) Superposition theorem
(c) Maximum power transfer theorem
(d) Millman's theorem

93. Can we use Thevenin's theorem on a circuit containing a BJT?
(a) Yes
(b) No*
(c) Depends on the BJT
(d) Insufficient data provided

94. The Norton current is the_____
(a) Short circuit current*

(b) Open circuit current
(c) Open circuit and short circuit current
(d) Neither open circuit nor short circuit current

95. Norton resistance is found by?
(a) Shorting all voltage sources
(b) Opening all current sources
(c) Shorting all voltage sources and opening all current sources*
(d) Opening all voltage sources and shorting all current sources

96. Norton's theorem is true for ——
(a) Linear networks*
(b) Non-Linear networks
(c) Both linear networks and nonlinear networks
(d) Neither linear networks nor non- linear networks

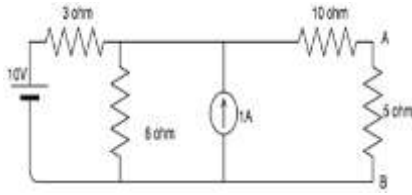97. Calculate the Norton resistance for the following circuit if 5 ohm is the load resistance.
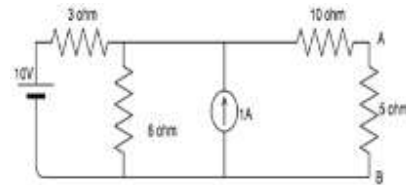
(a) 10 ohm
(b) 11 ohm
(c) 12 ohm*
(d) 13 ohm

98. Calculate the short circuit current is the 5 ohm resistor is the load resistance.
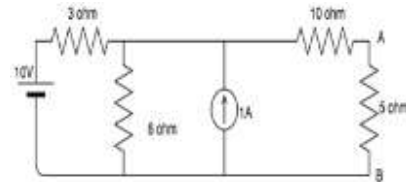
(a) 0.72A*
(b) 0.32A
(c) 0.83A
(d) 0.67A

99. Find the current in the 5 ohm resistance using Norton's theorem.

(a) 1A
(b) 1.5A
(c) 0.25A
(d) 0.5A*

100. Which of the following is also known as the dual of Norton's theorem?
(a) Thevenin's theorem*
(b) Superposition theorem
(c) Maximum power transfer theorem
(d) Millman's theorem

QUESTIONS FROM SSC/PSU EXAMS

101. Which of the following laws states that: in any electrical network, the algebraic sum of the currents meeting at a point is zero?
(a) Ohm's law
(b) Kirchhoff's Voltage Law (KVL)
(c) Faraday's law
(d) Kirchhoff's Current Law (KCL)*
(SSC JE 2018, 2021)

102. The SI unit of conductivity is-
(a) Ohm-m
(b) Ohm/m
(c) Mho-m
(d) Mho/m* (SSC JE 2018, 2014, PGCIL)

103. The capacitor in circuit opposes the sudden change of:
(a) Voltage
(b) temperature
(c) Energy
(d) current (SSC JE 2008, 2019, PSPCL 2019)

104. Ideal voltage source should have
(a) Zero internal resistance*
(b) Infinite internal resistance
(c) Large value of e.m.f.
(d) Medium internal resistance
(SSC JE 2017, 2019)

105. Which one of the following is the dimensional formula resistivity?
(a) $ML^3T^{-3}A^{-2}$ *
(b) $ML^3T^3A^2$
(c) $ML^3T^3A^{-2}$
(d) $ML^{-3}T^{-3}A^{-2}$ (SSC JE 2018, Air force 2021)
Hint: $\rho = RA/L$

106. Which of the following is the correct expression for the capacitance?
(a) $C = Q/V$*
(b) $C = Q - V$
(c) $C = QV$
(d) $C = V/Q$ (SSC JE 2018)

107. In parallel combination of capacitances, the equivalent capacitance is
(a) equal to the larges capacitance of the combination
(b) lower than the largest capacitance of the combination
(c) lower than the smallest capacitance of the combination
(d) greater than the largest capacitance of the combination*
(SSC JE 2015, 2017, 2018)
Hint: $\dfrac{1}{C_{eq}} = \dfrac{1}{C_1} + \dfrac{1}{C_2} + ... + \dfrac{1}{C_n}$

108. Determine the potential difference (in V) between the ends of a conductor when the conductor has a conductance of 0.4 Siemens and carrying a current of 8 A.
(a) 10
(b) 20*
(c) 30
(d) 50 (SSC JE 2018)
Hint: V = IR = I(1/conductance)

109. What will be the value of capacitance (in micro-Farad) of a capacitor when the potential difference between the terminals of the capacitor is 40 V and the charge stored in the capacitor is 8 mC?
(a) 150
(b) 180
(c) 200*
(d) 240 (SSC JE 2018)

110. Determine the temperature coefficient of resistance of a resistor at 0 degree Celsius, when the resistor has a resistance of 20 ohms at 0 degree Celsius and 40 ohms at 60 degree Celsius.
(a) 0.012
(b) 0.013
(c) 0.017*
(d) 0.019 (SSC JE 2018)
Hint:
$R_t = R_0 (1 + \alpha_0 \times \Delta t)$

111. A wire of 30 ohms resistance is stretched to double its original length and then cut into two equal parts. These two equal parts are connected in parallel with a battery that draws a current of 2 A. Determine the potential difference (in V) between the terminals of the battery.
(a) 30
(b) 60*
(c) 90
(d) 120 (SSC JE 2018)
Hint: $R_n = n^2 R = 2^2 x30 = 120\Omega$

$R_{eq} = \dfrac{60x60}{60+60} = 30\Omega$

V = IR = 2 x 30 = 60 V

112. What will be the value of current I_4 (in A) for the diagram given below?
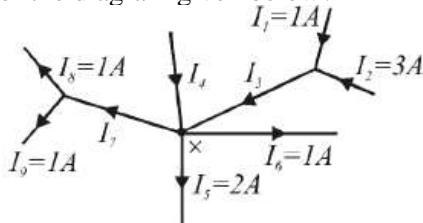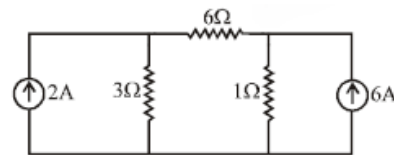

(a) 1*
(b) -1
(c) 2
(d) -2 (SSC JE 2015, 2018)
Hint: $I_3 + I_4 = I_7 + I_5 + I_6$

113. What will be the value of current (in A) drawn from the voltage source for the circuit given below?
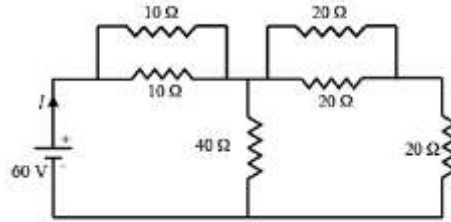
(a) 6.32
(b) 4.22
(c) 2.71*
(d) 1.72 (SSC JE 2018)

114. Determine the power dissipated (in W) by the 6 ohms resistor in the circuit given below

(a) 0*
(b) 6
(c) 36
(d) 120 (SSC JE 2018)
Hint: Apply nodal analysis
$$\frac{V_1}{3} + \frac{V_1 - V_2}{6} = 2$$
and $\dfrac{V_2}{I} + \dfrac{V_2 - V_1}{6} = 6$

115. What will be the peak value of voltage (in V) of a voltage waveform, when the root mean square value of the voltage is 30 V?
(a) 42.42*
(b) 41.14
(c) 40.24
(d) 40.62 (SSC JE 2018)
Hint: Peak value of voltage = value of r.m.s × √2

116. What will be the frequency (in Hz) of a sinusoidal wave, when the time-period of the wave is 2ms?
(a) 400
(b) 500*
(c) 600
(d) 800 (SSC JE 2018)
Hint: Frequency = 1/time period

117. What will the peak value of alternating voltage (in V) when the average value of the voltage is 140 V
(a) 216
(b) 214
(c) 220*
(d) 240 (SSC JE 2018)
Hint: Peak = average/0.637

118. Determine the capacitive reactance (in Ohms) of a circuit, if the supplied frequency is 50 Hz and the capacitance of the circuit is 60 micro Farad.
(a) 52.4
(b) 53.1*
(c) 54.4
(d) 55.5 (SSC JE 2018)
Hint: $X_C = \dfrac{1}{2\pi fC}$

119. Determine the value of reactive power (in VAR) of a circuit having power factor of 0.6 when the apparent power of the circuit is 120 VA.
(a) 75
(b) 78
(c) 84
(d) 96* (SSC JE 2018)
Hint: Power factor = cosϕ
Reactive power (Q) = (VA)sinϕ

120. Find the net capacitance of the combination in which ten capacitors of 10 μF are connected in parallel.
(a) 1μ F
(b) 0.1 μF
(c) 50 μF
(d) 100μF* (SSC JE 2010, 2018, 2019)
Hint: $C_{eq} = C_1 + C_2 + C_3 .... C_n$

121. A coil is wound with 50 turns and a current 8 A produces a flux of 200 μWb. Calculate inductance of the coil.
(a) 1.25 mH8
(b) 0.125 mH
(c) 0.25 mH
(d) 2.5 mH (SSC JE 2019)
Hint: L = Nϕ/I

122. The average value of a sinusoidal waves is
(a) 0.637 × maximum value*
(b) 0.5 × maximum value
(c) √2 × maximum value
(d) 2× maximum value (SSC JE 2018, 2019)

123. When only current source is active in the circuit, find the current through the 10Ω resistor?
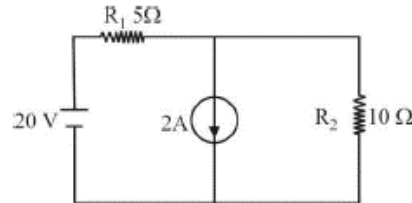
(a) 1.33 A
(b) 1.66 A
(c) 0 A
(d) 0.66 A* (SSC JE 2014, 2019)
Hint: Given that only current source is active so voltage source deactivate with equivalent resistance (Rₑ = 0)
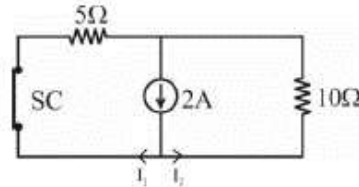
Apply current divider rule
$i_2 = I_{10\Omega} = 2x\dfrac{5}{5+10} A$

124. _____is the measuring unit of inductive susceptance.
(a) Mho*
(b) Tesla
(c) Henry
(d) Weber (SSC JE 2019)

125. Two bulbs of rating 230V, 60 W and 230 V, 100 W are connected in parallel across supply mains. Identify the correct statement.
(a) The 100 W bulb will glow brighter*
(b) Neither bulb will glow
(c) Both will glow equally bright
(d) The 60 W bulb will glow brighter
(SSC JE 2019)

Hint: For parallel connections of bulbs, higher rating of bulbs will glow brighter as compare to low rating because of lower resistance and for series connection lower rating bulb glows brighter.

126. How much power (in W) will be dissipated by a 5 Ohm resistor in which the value of current is 2 A?
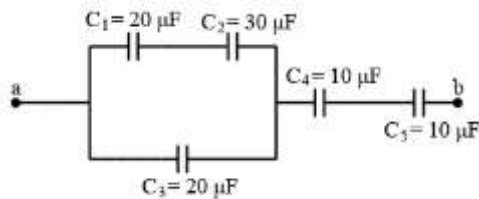(a) 10
(b) 30
(c) 20*
(d) 40 (SSC JE 2018)
Hint: $P = I^2R$

127. What is the resistivity (in Ohm-m) of a 2 Ohm cylindrical wire when the length and the diameter of the wire are 10 m and 0.4 m respectively?
(a) 0.025*
(b) 0.0025
(c) 0.25
(d) 0.05 (SSC JE 2018)
Hint: Resistivity $(\rho) = RA/l$

128. What is the equivalent capacitance (in μF) for the circuit given below?

(a) 4.56
(b) 4.32*
(c) 54.62
(d) 54.28 (SSC JE 2013, 2014, 2018)

129. What will be the resistance (in Ohms) of a lamp rated at 220 V, 200 W?
(a) 220
(b) 224
(c) 244
(d) 242* (SSC JE 2018)
Hint: R = V/P

130. Two wires of same resistivity have equal
length. The cross sectional area of first wire is two times to the area of the other. What will be the resistance (in Ω) of the wire that

has a large cross sectional area, if the resistance of the other wire is 20 Ω?
(a) 40
(b) 20
(c) 30
(d) 10* (SSC JE 2018)
Hint: $\dfrac{R_1}{R_2} = \dfrac{l_1}{l_2} \, x \, \dfrac{A_2}{A_1}$

131. What will be the resistance (in Ω) of bulb A for the circuit given below?
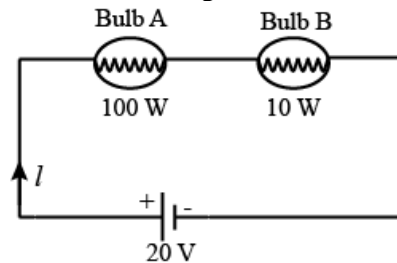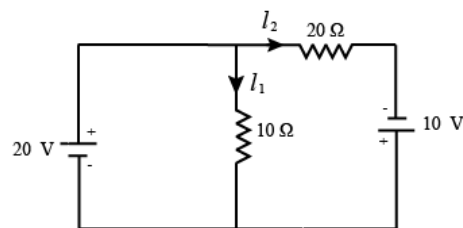

(a) 4.65
(b) 2.35
(c) 3.3*
(d) 1.33 (SSC JE 2018)
Hint: I = P/V = 110/20
Resistance of bulb A = P/I^2

132. Determine the value of current (in A) through both the resistors of the given circuit.

(a) –2, –1.5
(b) 2, 1.5*
(c) –2, 1.5
(d) 2, –1.5 (SSC JE 2018)
Hint: By applying nodal analysis,
I_1 = V/R = 20/10
I_2 = [20 - (-10)]/20

133. Determine the value of current I_1 (in A) and V_1 (in V) respectively, for the circuit given below.
(a) 4, 32*
(b) – 4, 32
(c) 6, 30

(d) – 6, 30 (SSC JE 2018)
Hint: Apply KCL,
Incoming current at Node 'x' = Outgoing current at Node "x"
$I_1 = 1 + 3 = 4$ Amp
Current flow through Node 'x' $I_1 = 4$ Amp
Now, $V_1 = I_1 \times R = 4 \times 8$

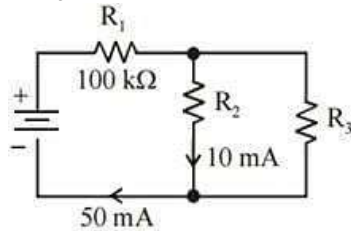134. Three resistors, each of 'R' Ω are connected in star. What is the value of equivalent delta connected resistors?
(a) 2 R Ω
(b) R/3 Ω
(c) 3 R Ω*
(d) R/2 Ω (SSC JE 2014)

135. Find R_3 for the circuit shown in figure:

(a) 25 ohm
(b) 25 kilo ohm*
(c) 25 mega ohm
(d) 25 milli ohm (SSC JE 2014)
Hint: Apply KCL
50 mA = 10 mA + I
I = 40 mA
By current division rule
Current in $R_2 = 10$ mA
= $R_3/(R_3 + 1000$ KΩ$) \times 50$ mA

136. If a 10- µF capacitor is connected to a voltage source with v(t) = 50 sin 2000 t V, then the current through the capacitor is __A.
(a) cos 2000 t*
(b) 500 cos 2000 t
(c) 10^6 cos 2000 t
(d) 5×10^{-4} cos 2000 t (SSC JE 2014)
Hint: $i_c(t) = C \dfrac{dV_c(t)}{dt}$

137. The magnetic field energy in an inductor changes from maximum value to minimum value in 5 msec when connected to an a.c. source. The frequency of the source is:
(a) 50 Hz*
(b) 200 Hz
(c) 500 Hz
(d) 20 Hz (SSC JE 2014)
Hint: f = 1/4T

138. Which of the following is non-linear circuit parameter ?
(a) Condenser
(b) Wire wound resistor
(c) Transistor*
(d) Inductance (SSC JE 2014)

139. Two electric bulbs have tungsten filament of same thickness . If one of them give 60 W and the other gives 100 W, then:
(a) 100 W lamp filament has longer length
(b) 60 W lamp filament has longer length*
(c) 60W and 100W lamp filaments have equal length
(d) 60W lamp filament has shorter length (SSC JE 2014)
Hint: P = 1/R and R ∝ L

140. Two 100 W, 200 V lamps are connected in series across a 200 V supply. The total power consumed by each lamp will be watts.
(a) 50
(b) 100
(c) 200
(d) 25* (SSC JE 2008, 2014)
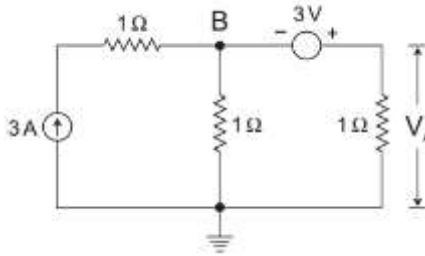
141. The power factor of industrial loads is generally :
(a) unity
(b) lagging*
(c) leading
(d) zero (SSC JE 2008)

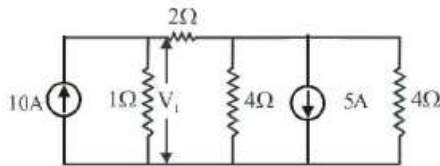142. The value of V in the circuit shown in the given figure is:

(a) 1V
(b) 2V
(c) 3V*
(d) 4V (SSC JE 2008)
Hint: Apply KCL at node B

$$\frac{V_B}{1} + \frac{V_B + 3}{1} = 3$$

and $V_A = 3x1$

143. For the circuit shown below, voltage V1 will be

(a) 2.64 V
(b) 3.64 V
(c) 6.0 V*
(d) 9.1 V (SSC JE 2007)
Hint: Take V_1 and V_2 voltage at node A and B respectively Applying nodal analysis at node A and B

$$\frac{V_1 - V_2}{2} + \frac{V_1}{1} = 10$$

and $\dfrac{V_2 - V_1}{2} + \dfrac{V_2}{4} + \dfrac{V_2}{4} + 5 = 0$

144. The effective value of voltage given by V = 100 + 25 sin 3ωt + 10 sin 5ωt will be
(a) 1000 V
(b) 101.8 V*
(c) 1.01 V
(d) 135 V (SSC JE 2007, 2012)

Hint: $\sqrt{100^2 + \left(\dfrac{25}{\sqrt{2}}\right)^2 + \left(\dfrac{10}{\sqrt{2}}\right)^2}$

145. The voltage v and current i of a device are v = 100 sin 377t, i = 10 sin (377t + 300) The power P indicated by wattmeter will be-

(a) 100 W
(b) 774 W
(c) 500 W
(d) 433 W* (SSC JE 2007)
Hint: Average power
= $V_{rms}I_{rms}\cos30$
= $(100/\sqrt{2})(10/\sqrt{2})(\sqrt{3}/2)$

146. The ratio of resistances of a 100 W, 220 V lamp to that of a 100 W, 110 V lamp will be at respective voltages
(a) 4*
(b) 2
(c) 1/2
(d) 1/4 (SSC JE 2010)

147. In series combination of resistance, the current through each resistance is
(a) higher in largest resistance
(b) lower in largest resistance
(c) same in each resistance*
(d) higher in smaller resistance
(SSC JE 2018)

148. What will be the value of equivalent capacitance, if three capacitors having capacitance C are connected in series?
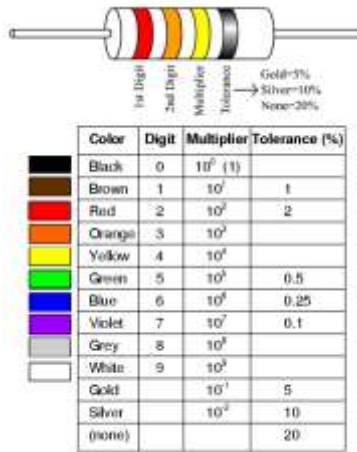(a) 3C
(b) C/3*
(c) 6C
(d) C/6 (SSC JE 2017, 2018)

Hint: $\dfrac{1}{C_{eq}} = \dfrac{1}{C_1} + \dfrac{1}{C_2} + \dfrac{1}{C_3}$

149. What will be the colour–coding of a resistor when the resistance of the resistor is 50 ± 2% ohms?
(a) Green–Black–Brown–Red
(b) Green–Black–Black–Brown
(c) Yellow–Brown–Black–Red
(d) Green–Black–Black–Red*
(SSC JE 2015, 2018)
Hint:

Color	Digit	Multiplier	Tolerance (%)
Black	0	10^0 (1)	
Brown	1	10^1	1
Red	2	10^2	2
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	0.5
Blue	6	10^6	0.25
Violet	7	10^7	0.1
Grey	8	10^8	
White	9	10^9	
Gold		10^{-1}	5
Silver		10^{-2}	10
(none)			20

150. What will be the value of current (in A) drawn from a 4V battery when a wire of 20 ohms resistance is stretched to double its original length and then cut into two equal parts and these equal parts are connected in parallel with the battery?
(a) 2
(b) 4
(c) 0.2*
(d) 0.4 (SSC JE 2018)
Hint: $R = \rho L / A$

R = Resistance
ρ = Resistivity
L = Length of wire
A = Cross-section area of wire
When a wire is stretched doubled its original length, cross sectional area will get half.
Hence the effective resistance will be 4 times.
Hence the resistance = 4 × 20 = 80 Ω
Now this wire is cut in to two equal parts.
Hence each wire will have 40 Ω resistance.
Now they are connected in parallel.
Equivalent resistance of the circuit = 20 Ω.
Current (I) = V / R = 4 / 20 = 0.2 A.

151. Determine the heat dissipated (in Joule) through a conductor of 10 ohms resistance, when 1 A of current is flowing through the conductor for 5 seconds.
(a) 50*
(b) 40
(c) 20
(d) 60 (SSC JE 2018)
Hint: $H = I^2RT$

152. Determine the voltage (in V) between point A and B for the given electrical circuit:
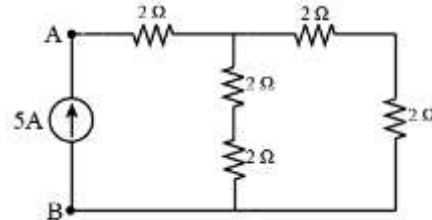
(a) 40
(b) 20*
(c) 60
(d) 30 (SSC JE 2018)

153. What will be the value of current (in A) through R_3 resistor, if a source of 3 V with internal resistance 3 Ω is connected at P–Q terminals with positive terminal at P?
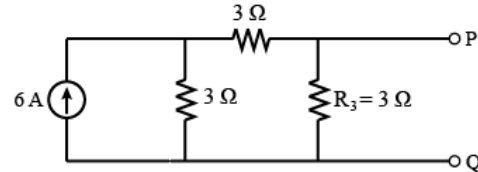
(a) 1.2
(b) 1.6*
(c) 2.2
(d) 2.6 (SSC JE 2018)
Hint: Apply 3 volts across Terminals P and Q, whose internal resistance is 3Ω, We get the following circuit
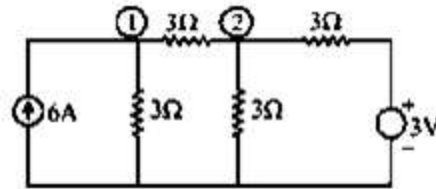
Applying Nodal Analysis in the circuit shown in second figure
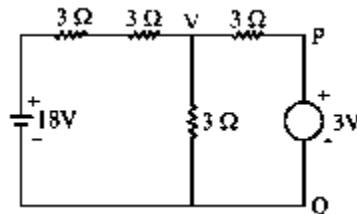
$$\frac{V-18}{(3+3)} + \frac{V}{3} + \frac{V-3}{3} = 0$$

154. The maximum voltage induced in the coil is 200V and the rotation angle of the coil is 45 degrees with respect to the coil. Find the instantaneous value of the sinusoidal waveform produced :
(a) $200 \sin 45^0$ *
(b) $200 \cos 45^0$
(c) $(200/\sqrt{2}) \sin 45^0$
(d) $(200/\sqrt{2}) \cos 45^0$(SSC JE 2018)
Hint: $V = V_m \sin \omega t$

155. There are N resistances, each are connected in parallel having value R with equivalent resistance of X. What will be the total resistance when these N resistances are connected in series?
(a) NX
(b) RNX
(c) X/N
(d) $N^2 X$* (SSC JE 2018)

156. 'Erg' is a unit of measurement for
(a) Energy*
(b) Power
(c) Voltage
(d) Impedance (SSC JE 2018)

157. What is the equivalent inductance (in H) between the terminals A and B in the circuit given below?
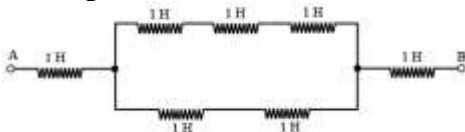
(a) 1
(b) 1.42
(c) 3.2*
(d) 7 (SSC JE 2018)
Hint: 1 H, 1H and 1H are in series
So, $L_1 = 1H + 1H + 1H = 3H$
Again 1H and 1H are in series
$L_2 = 1H + 1H = 2H$
Now L_1 and L_2 are in parallel
$$\frac{1}{L_3} = \frac{1}{L_1} + \frac{1}{L_2} = \frac{1}{3} + \frac{1}{2} = \frac{5}{6}$$
$L_3 = 6/5 = 1.2$ H
Therefore L_3, 1H and 1H inductance are in series.
$L_{eq} = 1H + 1H + L_3 = 1 + 1 + 1.2 = 3.2$ H

158. Kirchhoff's voltage law is based on which of the following principle?
(a) Conservation of charge
(b) Conservation of energy*
(c) Conservation of force
(d) Conservation of momentum
(SSC JE 2018)

159. What is the value of an unknown voltage 'V' (in V) across the terminal A and B, in the circuit given below?
(a) 6
(b) 10
(c) 12*
(d) 16 (SSC JE 2018)

160. How much time (in sec) will be taken by 40 C of charge to pass through a point in a circuit, if a current of 8 A flows through it?
(a) 2
(b) 3
(c) 4
(d) 5* (SSC JE 2018)
Hint: $Q = it$

161. Three electric lamps of 70 W each are connected in parallel across AC mains. What is the total power consumed (in W) by the parallel combination?
(a) 70
(b) 140
(c) 210*
(d) 380 (SSC JE 2018)

162. The dimensions of a cuboidal metal strip are a = 5 cm, b = 15 cm and c = 10 cm. What is the ratio of resistances $R_a:R_b:R_c$ between the respective pairs of opposite faces?
(a) 1 : 3 : 5
(b) 1 : 3 : 2
(c) 1 : 9 : 4*
(d) 1 : 9 : 16 (SSC JE 2018)
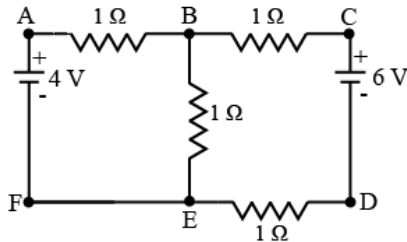Hint: $R = \rho l/A$
$R_a = a/(b \times c) = 5/150 = 1/30$
$R_b = b/(a \times c) = 15/50 = 3/10$
$R_c = c/(b \times a) = 10/75 = 2/15$

163. In which combination, the electrical appliances are connected at home?

(a) Series
(b) Parallel*
(c) Series–parallel
(d) None of these (SSC JE 2018)

164. How many nodes and junctions are present respectively in the circuit shown below?

(a) 5, 2*
(b) 5, 5
(c) 2, 2
(d) 2, 5 (SSC JE 2018)
Hint: There are five nodes (A, B, C, D, E or F) and two junctions (B, E) in the given circuit, because junction is a meeting point of three or more than three branches.

165. Determine the potential difference (in V) between nodes B and D.
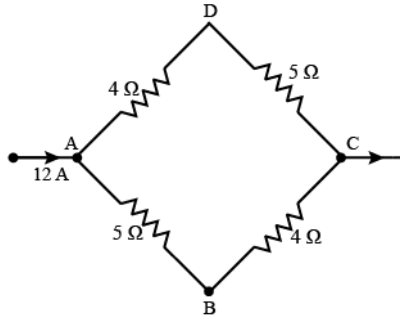
(a) –5
(b) 5
(c) –6*
(d) 6 (SSC JE 2018)
Hint: See following figure
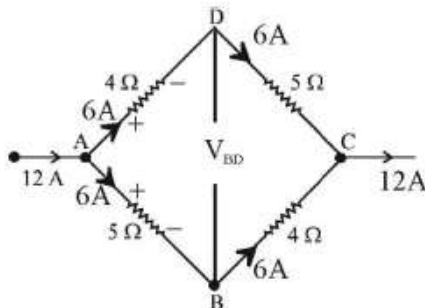
In the given circuit, point A and C are parallel and path ADC, ABC have same resistance (9 Ω). Resistance of path ADC = $5 + 4 = 9 \, \Omega$
Resistance of path ABC $= 4 + 5 = 9 \, \Omega$
So current flowing in branch, ADC and ABC is 12/2 = 6 Amp
Voltage across point AD = IR = 6 A × 4 Ω = 24 volt
Voltage across point AB = I × R = 6 Ω × 5 Ω = 30 volt
Potential difference between B and D,
$V_D - V_C = 30 \, V$ (i)
$V_B - V_C = 24 \, V$ (ii)
Now solve.

166. The open circuit voltage across the load terminals is 30 V. The terminal voltage drops to 20 V, when the load of 15 ohms is connected across the open circuited terminals. What is the internal resistance (in ohms) of the source?
(a) 5.5
(b) 6
(c) 7
(d) 7.5* (SSC JE 2018)
Hint: Load terminal voltage equals to source terminal voltage in case of open circuit,
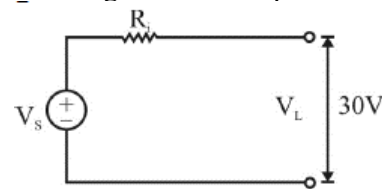
So, $V_S = V_L = 30 V$
When adding 15Ω resistance,
$I = V/R = 20/15 = 4/3 \, amp$
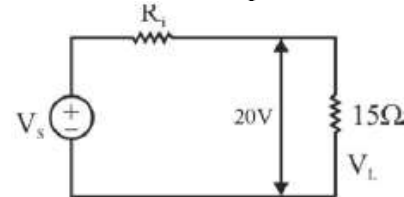
Where, R_i is internal resistance resistance are connected in series and current will be same.
Voltage drop due to 20V load voltage drop,
$V_i = V_S - V_L = 30 - 20 = 10V$
internal resistance $R_i = V/I$

167. Determine the current 'l' (in A) delivered by the source in the circuit given below:

220 V
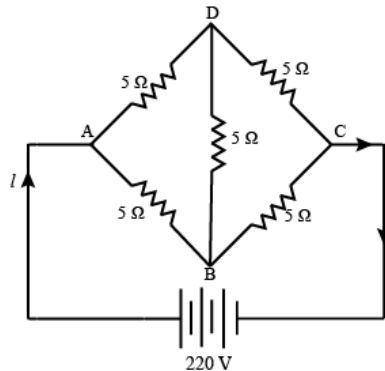
(a) 35
(b) 38
(c) 42
(d) 44* (SSC JE 2018)

168. Determine the average value of alternating current (in A) when the peak value of current is 14 A.
(a) 8.92*
(b) 6.56
(c) 4.26
(d) 2.94 (SSC JE 2018)
Hint: $I_{avg} = 0.637 \times I_p$

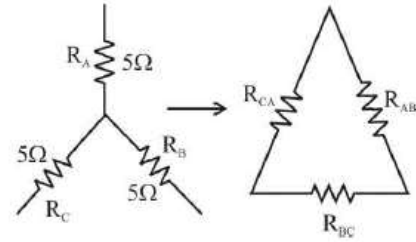169. The equivalent resistance between terminals X and Y of the network shown is
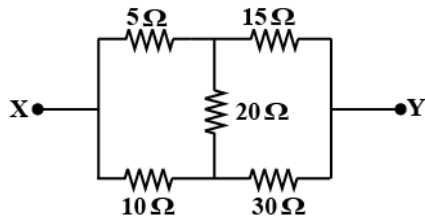
(a) 8 Ω
(b) 100/3 Ω
(c) 40/3 Ω*
(d) 20/9 Ω (SSC JE 2012)

170. Three resistances 5 Ω each are connected in star. Values of equivalent delta resistances are
(a) 1.5Ω each
(b) 2.5Ω each
(c) 5/3Ω each
(d) 15Ω each* (SSC JE 2012)
Hint: See figure.

$$R_{AB} = R_A + R_B + \frac{R_A R_B}{R_C}$$

171. An electric iron is rated at 230 V, 400 W, 50 Hz. The voltage rating 230 V refers to
(a) rms value*
(b) peak-to-peak value
(c) average value
(d) peak value (SSC JE 2012)

172. A non- sinusoidal periodic waveform is free from DC component, cosine components and even harmonics. The waveform has
(a) half wave and odd function symmetry*
(b) half wave and even function symmetry
(c) only odd function symmetry.
(d) only half wave symmetry (SSC JE 2012)

173. Form factor of an alternating wave is
(a) Form factor = average value/RMS value
(b) Form factor = (RMS value)2/Average value
(c) Form factor = RMS value/Average value*
(d) Form factor = RMS value × Average value (SSC JE 2012)

174. Which of the following is the best conductor of electricity?
(a) Warm water
(b) Salt water*
(c) Cold water
(d) Distilled water (SSC JE 2012)

175. A 20 micro farad capacitor is connected across an ideal voltage source. The current in thecapacitor
(a) will be very high at first, then exponentially*
decay and at steady state will become zero.

(b) None of these are true
(c) will be zero at first, then exponentially rise.
(d) will be very high at first, then exponentially decay (SSC JE 2012)

176. Three lamps are in circuit as shown in Figure.
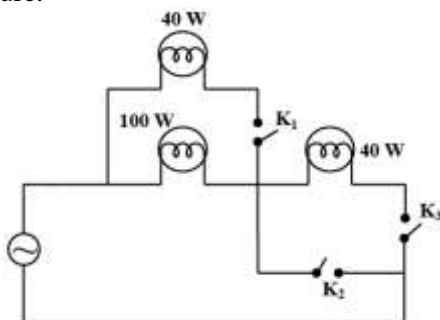
At what condition 100 W lamp will have the maximum brightness?
(a) K1 is closed, K2 is open and K3 is also open
(b) Both (c) and (d)
(c) Key K1 is closed, K2 is open and K3 is closed
(d) Key K1 is open, K2 is closed and K3 is open* (SSC JE 2012)
Hint: Resistance of 100 W bulb = 2002/100 = 400ohms
Resistance of 60 W bulb = 2002/60 = 666.67ohms
Resistance of 40W bulb = 2002/40 = 1000 ohms
Therefore, total resistance in series = (400 + 666.67 + 1000) = 2066.67ohms
Current in the circuit = 200/2066.67 = 0.0967A
Therefore, actual power consumed by "40W" bulb = 0.0967^2 x 1000 = 9.35W (much lesser than any of the original)
The 40 W bulb will grow the brightest as the current is constant in all three and it has the maximum resistance. But it would consume much less than 40W as the bulbs are connected in series, and voltage would be divided across all three filaments depending upon resistances.

177. What will be the voltage (in V) across a 8 H inductor, when the rate of change of current in the inductor is 0.5 Amp/sec.

(a) 2
(b) 6
(c) 4*
(d) 8 (SSC JE 2015, 2018)
Hint: e = L(di/dt)

178. Determine the voltage (in V) of a battery connected to a parallel plate capacitor (filled with air) when the area of the plate is 10 square centimetres, the separation between the plates is 5 mm and the charged stored on the plates is 20 pC.
(a) 12.3
(b) 10.3
(c) 11.3*
(d) 14.3 (SSC JE 2018)
Hint: $C = \dfrac{\varepsilon A}{d} = \dfrac{\varepsilon_0 \varepsilon_r A}{d}$
and V = q/C

179. What will be the equivalent resistance (in ohms) between the point x and y for the given electrical network?
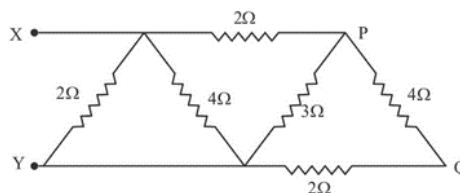
(a) 2
(b) 1*
(c) 4
(d) 3 (SSC JE 2015, 2017, 2019)

180. Determine the power delivered (in W) by the current source for the given electrical circuit:
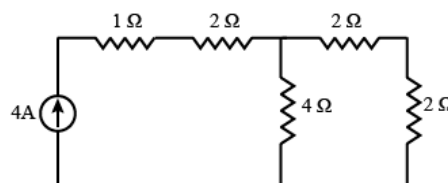
(a) 80*
(b) 40
(c) 60
(d) 30 (SSC JE 2018)

181. Two resistors are connected in parallel to a stable voltage source. How do current

and power of the resistor R_1 change when the resistance of R_2 is decreased by half?
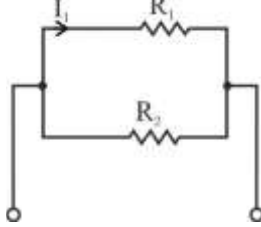
(a) Current is constant and power decreases
(b) Current increases and power is constant
(c) Both current and power constant*
(d) Both current and power decrease
(SSC JE 2017)

182. If a capacitor is charged by a square wave current source, the voltage across the capacitor is
(a) a square wave
(b) triangular wave*
(c) step function
(d) zero (SSC JE 2017)

183. Kirchhoff's voltage law applied to circuit with
(a) Linear elements only
(b) Non-linear elements only
(c) Linear, non-linear, active and passive elements
(d) Linear, non-linear, active, passive time variant as well as time invariant elements*
(SSC JE 2017)

184. Which of the following is an active element of circuit?
(a) Resistance
(b) Inductance
(c) Capacitance
(d) Ideal current source *
(SSC JE 2017, 2018)

185. In electronic circuits, for blocking the DC component of a voltage signal, a/an___ is connected in series with the voltage source.
(a) capacitor *
(b) diode
(c) resistor
(d) inductor (SSC JE 2013)

186. A geyser is operated from 230 V, 50 c/s mains. The frequency of instantaneous power consumed by the geyser is
(a) 25 c/s
(b) 50 c/s
(c) 100 c/s*
(d) 150 c/s (SSC JE 2013)
Hint: Frequency of instantaneous power consumed = 2 f

187. In a 3-phase 400 V, 4-wire system, two incandescent lamps, one having 230 V, 100 W specification and the other 230 V, 200 W are connected between R phase-neutral and Y phase-neutral respectively. If the neutral wire breaks
(a) 100 W lamp will fuse first*
(b) 200 W lamp will fuse first
(c) both the lamps will fuse together
(d) both the lamps will glow (SSC JE 2013)
Hint: The 100W lamp will fail first, Although the voltage across the 100 w lamp will be higher (293V), it will fail because of the effective current (0.489A) which is more than the 100 w lamp's normal current (0.4A). An increase in current causes more heat and the heating element will fail.

188. We have three resistances each of value 1 Ω , 2Ω and 3Ω. If all the three resistances are to be connected in a circuit, how many different values of equivalent resistance are possible?
(a) Five
(b) Six
(c) Seven
(d) Eight* (SSC JE 2013)

189. An electric heater draws 1000 watts from a 250 V source. The power drawn from a 200 V source is
(a) 800 W
(b) 640 W*
(c) 1000 W
(d) 1562.5 W (SSC JE 2013)

190. A voltage source having an open-circuit voltage of 150 V and internal resistance of 75 Ω, is equivalent to a current source of
(a) 2 A in series with 75 Ω

(b) 2 A in parallel with 37.5 Ω
(c) 2A in parallel with 75 Ω*
(d) 1 A in parallel with 150 Ω
(SSC JE 2013)

191. There are 3 lamps 40 W, 100 W and 60 W. To realise the full rated power of the lamps they are to be connected in:
(a) Series or parallel
(b) Series only
(c) Parallel only*
(d) Series-parallel (SSC JE 2015)

192. A node in a circuit is defined as a :
(a) closed path
(b) junction of two or more elements*
(c) group of interconnected
(d) open terminal of an element.
(SSC JE 2014, 2015)
Hint:
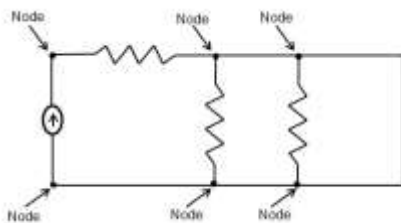
193. If the power factor is high, then the consumer maximum KVA demand:
(a) remains constant
(b) increases
(c) decreases*
(d) becomes Zero (SSC JE 2015)
Hint: Power factor= Real power / Apparent power
Now since real power consumed by a consumer will remain same it's the apparent power that changes. For high power factor Apparent power will be less (so that the ratio increases) and will almost be equal to real power. But as the power factor becomes poor apparent power increases hence KVA also increases. Hence the KVA will decrease if the power factor of the load improves.

194. An active element in a circuit is one which :
(a) both receives and supplies energy
(b) dissipates energy
(c) supplies energy*
(d) receives energy (SSC JE 2015)

195. Determine the conductance (in Siemens) of a conductor, when the potential difference between the ends of the conductor is 30 V and the current flowing through the conductor is 3 A.
(a) 0.1*
(b) 1.1
(c) 2.4
(d) 4.2 (SSC JE 2018)
Hint: G = 1/R Siemens

196. Determine the energy stored (in J) by a 5 H inductor, when the current flowing through the inductor is 6 A.
(a) 94
(b) 90*
(c) 60
(d) 40 (SSC JE 2018)
Hint: $E = (1/2)LI^2$

197. Determine the value of current I (in A) drawn from the voltage source for the circuit given below.
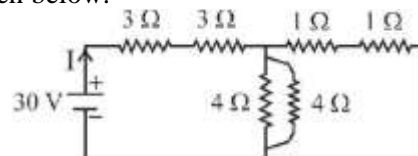
(a) 2.5
(b) 3.4
(c) 4.3*
(d) 6.5 (SSC JE 2018)

198. Which of the following represents the relation between the peak value and RMS value of voltage for a sine wave?
(a) $V_{rms} = 1.412V_{peak}$
(b) $V_{rms} = 0.637V_{peak}$
(c) $V_{rms} = 0.424V_{peak}$
(d) $V_{rms} = 0.707V_{peak}$* (SSC JE 2018)

199. Determine the average value of an alternating current (in A) when the peak value of the current is 10 A.
(a) 14.14
(b) 10.63
(c) 6.37*
(d) 4.36 (SSC JE 2018)

Hint: $I_{avg} = 2I_{peak}/\pi$

200. Observe the figure and find the correct relation from the four given options?
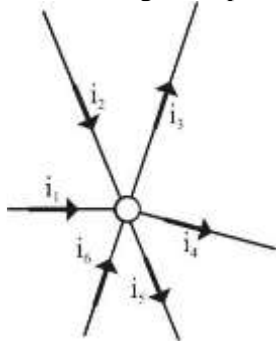
(a) $i_1 + i_2 + i_6 = i_4 + i_5 + i_3$*
(b) $i_4 + i_2 + i_3 = i_1 + i_5 + i_6$
(c) $i_1 + i_2 + i_4 = i_3 + i_5 + i_6$
(d) $i_1 + i_2 + i_3 = i_4 + i_5 + i_6$ (SSC JE 2019)
Hint: Kirchhoff law

201. Which of the following is the correct way of expressing the rating of a fuse?
(a) Watts
(b) Amperes*
(c) Volts
(d) Ampere-hours (SSC JE 2019)

202. The names of four materials have been given, select the one which has the least resistivity at 20^0C?
(a) Iron
(b) Silver*
(c) Glass
(d) Nichrome (SSC JE 2019)

203. In parallel combination of resistance, the voltage is
(a) lower across largest resistance
(b) higher across largest resistance
(c) same across each resistance*
(d) higher across smaller resistance
(SSC JE 2018)

204. Electrical conductivity of a conductor is measured in
(a) Siemens
(b) Ohms
(c) Siemens/meter*
(d) Ohms/meter (SSC JE 2018)

205. Which of the following wave will have the highest RMS value for equal peak values?
(a) Sine wave
(b) Sawtooth wave
(c) Square*
(d) Triangular (SSC JE 2018)
Hint:
sine wave
RMS value = 0.707 (Peak)
Average value = 0.637 (Peak)
square wave
RMS value = Peak value
Average value = Peak value
triangular wave
RMS value = 0.577 Peak
Average value = 0.5 Peak

206. Which one of the following has the least number of free electrons in it?
(a) Conductors
(b) Semiconductor
(c) Superconductor
(d) Insulators* (SSC JE 2018)

207. The closed path made by the combination of several branches of the network is called as
(a) terminal
(b) circuit
(c) loop*
(d) junction (SSC JE 2018)

208. Who invented the alternating current?
(a) Tesla*
(b) Faraday
(c) Maxwell
(d) Edison (SSC JE 2018)

209. Determine the source voltage V_s
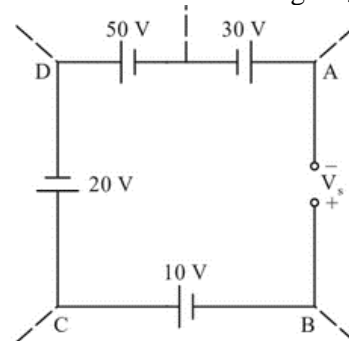
(a) –30 V
(b) 20 V
(c) 30 V*
(d) –20V (SSC JE 2020)
Hint: By KVL
-V_S - 10 + 20 + 50 - 30 = 0

210. The relationship between Electrical Power and current is
(a) linear
(b) non-linear*
(c) constant
(d) exponential (SSC JE 2018)

211. Kirchhoff's voltage law is concerned with
(a) IR drop
(b) Battery e.m.f.
(c) Junction voltage
(d) both (a) and (b)* (SSC JE 2018, 2020)

212. For solving electric circuits, nodal voltage method is based on
(a) KVL and ohms law
(b) KCL and ohms law*
(c) KCL and KVL
(d) KCL, KVL and ohms law (SSC JE 2017)

213. Kirchhoff's law states that in a closed loop of a circuit
(a) That total current, algebraically summed is zero
(b) The algebraic sum of the potential differences is zero*
(c) Voltage across component is zero
(d) None of these (SSC JE 2017)

214. Which circuit will not always produce any transients?
(a) RL circuit
(b) Linear circuit
(c) RLC circuit
(d) Pure resistive circuit* (SSC JE 2020)
Hint: he inductor and the capacitor store energy in the form of the magnetic field and electric field respectively, and hence these elements have transients.
Circuits containing only resistive element has no transients because resistors do not store energy in any form.

215. The time constant of an RC circuit is :
(a) RC*
(b) √RC
(c) R/C
(d) C/R (SSC JE 2018)

216. The transient current in RLC circuit is oscillatory when:
(a) R = 2√L/C
(b) R = 0
(c) R > 2√L/C
(d) R < 2√L/C* (SSC JE 2014)

217. Determine the transient time (in seconds) of a series RC circuit, when the capacitance of the circuit is 4 mF and the resistance of the circuit is 6 kilo-Ohms.
(a) 24*
(b) 22
(c) 20
(d) 18 (SSC JE 2018)
Hint: τ = RC

218. Calculate the time (in seconds) taken by a series RL circuit having inductance of 0.6 H and resistance of 30 ohms to reach a steady state value.
(a) 0.02
(b) 0.05
(c) 0.1*
(d) 0.5 (SSC JE 2018)
Hint: τ = L/R

219. Time constant of the network shown in figure is
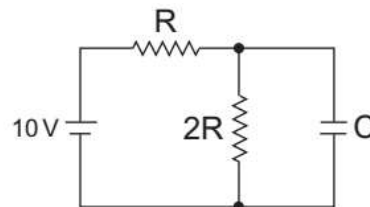
(a) 2 RC
(b) 3 RC
(c) RC/2
(d) 2RC/3* (SSC JE 2010)
Hint: τ = $R_{eq}C_{eq}$

220. A constant voltage of 60 V is applied at t = 0 across a series R–L circuits as shown

in the figure Determine the current (in A) in the circuit at t = 0
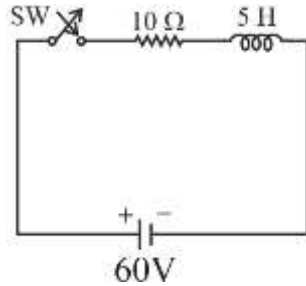
(a) 4
(b) 3
(c) 0*
(d) 2 (SSC JE 2018)

221. What will be the transient time (in seconds) of a series RC circuit, when the capacitance of the circuit is 8 mF and the resistance of the circuit is 8 kilo–Ohms?
(a) 64*
(b) 52
(c) 44
(d) 36 (SSC JE 2018)

222. The time constant of the network shown in the figure is
(a) CR/4
(b) CR/2
(c) CR*
(d) 2 CR (SSC JE 2012)

223. The transient currents are due to
(a) voltage applied to circuit
(b) resistance of the circuit
(c) impedance of the circuit
(d) changes in stored energy in inductors and capacitance* (SSC JE 2017)

224. A coil with a certain number of turns has a specified time constant. If the number of turns is doubled, its time constant would
(a) remain unaffected
(b) become double*
(c) become four-fold
(d) get halved (SSC JE 2014)

225. The impulse response of an R-L circuit is a___
(a) rising exponential function
(b) decaying exponential function*
(c) step function

(d) parabolic function (SSC JE 2017)

226. In the circuit shown in the figure below, it is desired to have a constant direct current i(t) through the ideal inductor L. The nature of the voltage source v(t) must be:
(a) constant voltage
(b) linearly increasing voltage
(c) an ideal impulse*
(d) exponentially increasing voltage
(SSC JE 2017)

227. Which one of the following can act as an open circuit for dc and a short circuit for ac of high frequency ?
(a) An inductor
(b) A capacitor*
(c) A resistor
(d) None of these
(SSC JE 2017)

228. The current and voltage in the given element are i(t) $=5e^{-5t}$ A and V(t) = $10e^{-5t}$ V for t $\geq$0, respectively. Both V(t) and i(t) are zero for t <0. Find the power supplied to the element?
(a) p(t) = 50 e^{-5t} W
(b) p(t) = 10 e^{-5t} W
(c) p(t) = 50 e^{-25t} W
(d) p(t) = 50 e^{-10t} W* (SSC JE 2021)

229. Superposition theorem is valid for which of the following circuit elements?
(a) Non-linear elements
(b) Passive elements
(c) Linear bilateral elements*
(d) Resistive elements (SSC JE 2009, 2014)

230. When a source is delivering maximum power to the load, the efficiency will be
(a) 50%*
(b) 100%
(c) 99%
(d) 25% (SSC JE 2008, 2014, 2017, 2018)
Hint: The efficiency is only 50% when maximum power transfer is achieved, but approaches 100% as the load resistance approaches infinity, though the total power level tends towards zero.

231. Maximum power transfer from source to load resistance is _____ the internal resistance of the circuit.
(a) equal to*
(b) more than
(c) less than
(d) double (SSC JE 2011)

232. Thevenin's theorem converts a circuit to an equivalent form consisting of
(a) a current source and a series resistance
(b) a voltage source and a parallel resistance
(c) a voltage source and a series resistance*
(d) a current source and a parallel resistance (SSC JE 2012)
Hint:
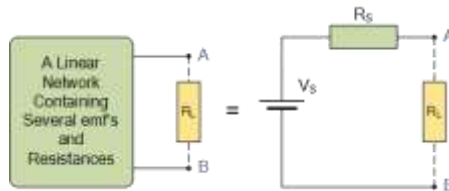
233. Application of Norton's theorem in a circuit results in
(a) a current source and an impedance in parallel*
(b) a voltage source and an impedance in series
(c) an ideal voltage source
(d) an ideal current source (SSC JE 2013)
Hint: Norton's theorem states that "any circuit has several energy sources; resistances can be replaced by an equivalent current source in parallel with the single resistance"
From this explanation, we get a direct answer option. That Norton theorem gives an equivalent circuit with an equivalent current source in parallel with equivalent impedance.

$$r = R_2 + \frac{R_1 R_3}{R_1 + R_3}$$
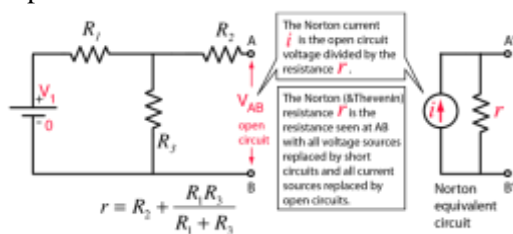
234. Which one of the following theorem is the converse of Thevenin's theorem?

(a) Superposition theorem
(b) Millman's theorem
(c) Compensation theorem
(d) Norton's theorem* (SSC JE 2018)

235. What will be the Norton's resistance (in ohms) between terminals A and B for the circuit given below?
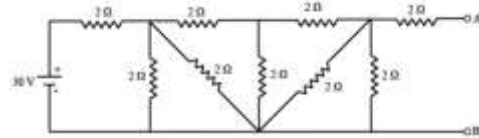
(a) 2.25
(b) 2.75*
(c) 3.25
(d) 3.75 (SSC JE 2018)
Hint: Voltage source should be short circuit for obtaining Norton's equivalent resistance.

236. What will be the value of Norton's current (in A) through load resistance RL for the given electrical circuit?
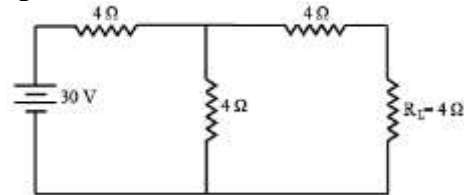
(a) 6.2
(b) 5.2
(c) 4.2
(d) 2.5* (SSC JE 2018)
Hint: To find Norton's current load resistance (R_L) should be short circuit.

237. The Norton's current in the circuit shown below is
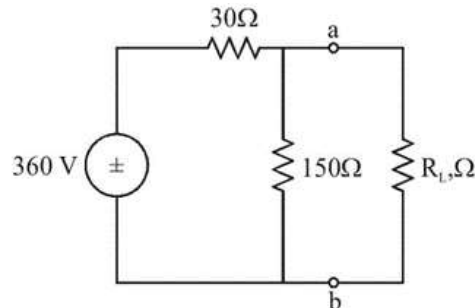
(a) 2 A
(b) 120 A
(c) 4 A
(d) 12 A* (SSC JE 2019)

Hint: According to the Norton theorem, to find the Norton current, the load is removed by a short circuit.

238. The Thevenin's resistance as seen through the terminal A and B is
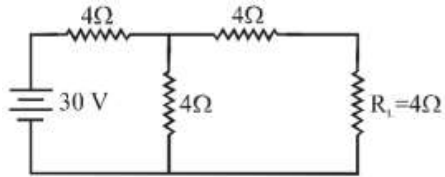
(a) 7 Ω
(b) 6Ω
(c) 5 Ω*
(d) 4Ω (SSC JE 2019)
Hint: Short circuit 2V and 25 V voltage source.

239. Which of the following statement is CORRECT?
(a) Norton's theorem is same as superposition theorem
(b) Norton's theorem is the converse of superposition theorem
(c) Norton's theorem is same as Thevenin's theorem
(d) Norton's theorem is the converse of Thevenin's theorem*
(SSC JE 2018)
Hint: Norton's theorem is the converse of Thevenin's theorem. It consists of the equivalent current source instead of an equivalent voltage source as in Thevenin's theorem.

240. What is the value of Norton's resistance (in Ω) between the terminal A and B for the given Norton's equivalent circuit?
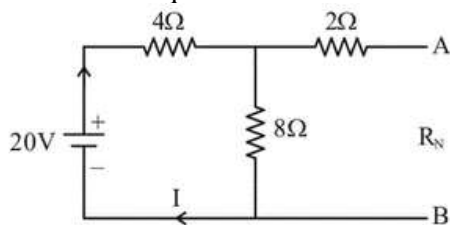
(a) 2
(b) 4
(c) 4.66*
(d) 5.6 (SSC JE 2018)
Hint: Short circuit voltage source.

241. What will be the value of Thevenin's voltage (in V), Thevenin's resistance (in Ω) and the load current (in A) respectively, across the load resistor in the given electrical circuit?
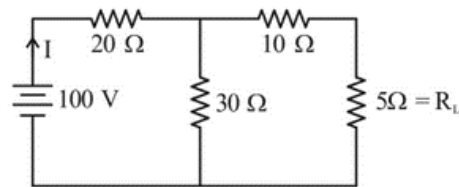
(a) 40, 22, 2.22
(b) 50, 32, 1.11
(c) 60, 22, 2.22*
(d) 60, 32, 1.50 (SSC JE 2018)
Hint: In Given circuit applying Thevenin's theorem, Voltage source will be short circuited and load resistance (R_L) will be open.

242. Determine the Norton's current (in A) and Norton's resistance (in Ω) respectively, for the given electrical circuit across the load resistance' R_L
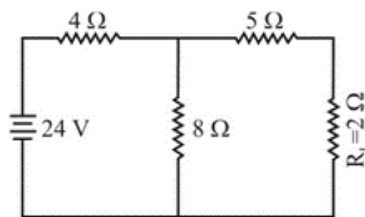
(a) 2.09, 7.66*
(b) 2.34, 3.45
(c) 4.34, 3.26
(d) 2.34, 2.55 (SSC JE 2018)

243. Using Millman's theorem, find the current through the load resistance R_L of 3 Ω resistance shown below:
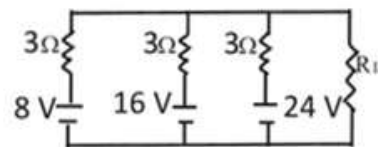
(a) 6 A
(b) 8 A
(c) 12 A
(d) 4 A* (SSC JE 2014)

Hint: $V_m = \dfrac{V_1 G_1 + V_2 G_2 + V_3 G_3}{G_1 + G_2 + G_3}$

$$R_m = \frac{1}{G_1 + G_2 + G_3}$$

G = 1/R

244. If R_g in the circuit shown in figure is variable between 20 Ω and 80 Ω then maximum power transferred to the load R_L will be
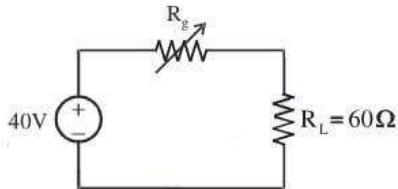
(a) 15 W*
(b) 13.33 W
(c) 6.67 W
(d) 2.4 W (SSC JE 2010)
Hint: I = V/(R_g + R_L) and
Power transferred = I^2R_L

245. Which of the following theorem states that the sum of instantaneous power in 'n' number of branches of an electrical network is zero?
(a) Compensation
(b) Maximum power transfer
(c) Superposition
(d) Tellegen's* (SSC JE 2018)

246. What will be the value of source impedance (in Ohms) for transmitting maximum power to the load in the circuit given below?
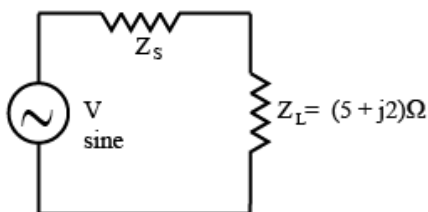
(a) 5+ j2
(b) 5 – j2*
(c) 2 + j5
(d) 2 – j5 (SSC JE 2018)
Hint: For transmitting maximum power to load in the circuit in question the value of source impedance must be equal to complex conjugate of load impedance.

247. Determine the maximum power (in W) transferred from the source to the load of the circuit given below:
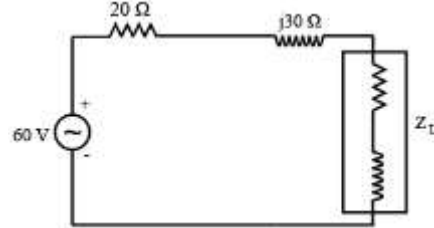
(a) 18
(b) 30
(c) 45*
(d) 90 (SSC JE 2018)
Hint: Source impedance = conjugate of load impedance = (20 − j30)
∴ R_L = 20 Ω
Now, P_{max} = V^2/4R_L

248. The current through Z_L in the circuit shown below will be
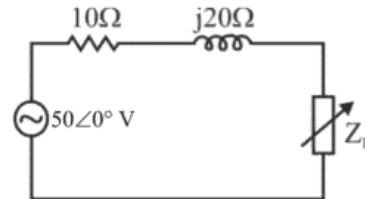
(a) 2.5 Ampere*
(b) 0.66 Ampere
(c) 0.33 Ampere
(d) 1 Ampere (SSC JE 2017)
Hint: Source impedance (Z_{th}) = conjugate of load impedance (Z_L) = conjugate of 10 + j20 = (10 − j20)
Now, $I = \dfrac{V}{Z_L + Z_{th}}$

249. Which of the following theorems enables a number of voltage (or current) source to be combined directly into a single voltage (or current) source?
(a) Compensation theorem
(b) Reciprocity theorem
(c) Superposition theorem
(d) Millman's theorem* (SSC JE 2017)

250. Superposition theorem requires as many circuits to be solved as there are
(a) nodes
(b) sources*

(c) loops
(d) None of the above (SSC JE 2013)

251. The Superposition theorem is used when the circuit contains
(a) A single voltage source
(b) active elements only
(c) a number of voltage sources*
(d) passive elements only (SSC JE 2015)

252. Thevenin's theorem cannot be applied to
(a) linear circuit
(b) nonlinear circuit*
(c) active circuit
(d) passive circuit (SSC JE 2015)

253. Which one of the following is the CORRECT statement for superposition theorem?
(a) The algebraic sum of all the voltages around any closed path is zero.
(b) The overall current in any part of a linear circuit is equal to the algebraic sum of the currents produced by each source separately*
(c) The sum of currents entering a node is equal to the sum of currents leaving the node.
(d) The algebraic sum of all the voltages around any closed path is equal to one. (SSC JE 2018)

254. Which one of the expression satisfies the condition of maximum power transfer theorem?
(a) $Z_L = Z_S{}^*$ *
(b) $Z_L = R_L$
(c) $Z_L = 2Z_S$
(d) $X_L = R_L$ (GPSC 2021, SSC JE 2018)
Hint: If source impedance is complex then load impedance has to be a complex conjugate of source impedance for maximum power transfer to occur.

255. What will be the value of load impedance (in ohms) for transmitting maximum power from the source to load when the source impedance is 8 + j4 ohms?
(a) 8 − j4*
(b) 8 + j4

(c) 4 + j8
(d) 4 − j8 (SSC JE 2018)
Hint: If source impedance is complex then load impedance has to be a complex conjugate of source impedance for maximum power transfer to occur.

256. On which of the following concept, the superposition theorem is based?
(a) Duality
(b) Linearity*
(c) Reciprocity
(d) Non-Linearity (SSC JE 2018)

257. Determine Thevenin's equivalent resistance (in Ohms) and voltage (in V) respectively across terminal 'a' and 'b' for the given electrical circuit.
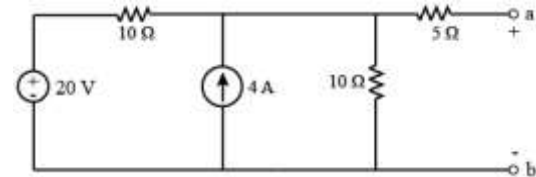
(a) 12, 40
(b) 20, 80
(c) 10, 30*
(d) 10, 50 (SSC JE 2018)
Hint:
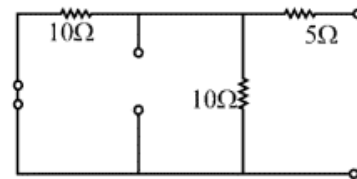
$R_{th} = 10 \,||\, 10 + 5$

$= \dfrac{10 x 10}{10 + 10} + 5$

Thevenin voltage
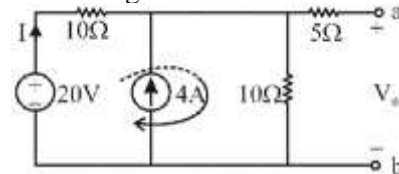
Applying KVL in loop (1)
20 = 10i + (4 + i)10
i = −1
Applying KVL in loop (2)
(4 + i) × 10 + 0 × 5 = V_{th}
V_{th} = 30

258. Which one of the following statement is TRUE?
(a) Superposition theorem is not applicable for voltage calculation.
(b) Superposition theorem is not applicable for power calculation*
(c) Superposition theorem is not applicable for bilateral elements.
(d) Superposition theorem is not applicable for passive elements. (SSC JE 2018)
Hint: Superposition theorem is not applicable for power calculation.
Superposition theorem is applicable only for linear network.

259. For the circuit shown below, find the Millman's equivalent current source (in A) across the terminals x-y.
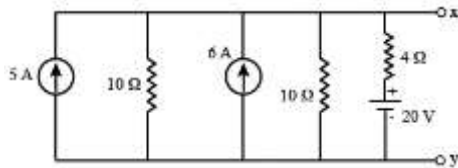
(a) 5
(b) 10
(c) 12
(d) 1*6 (SSC JE 2018)
Hint:
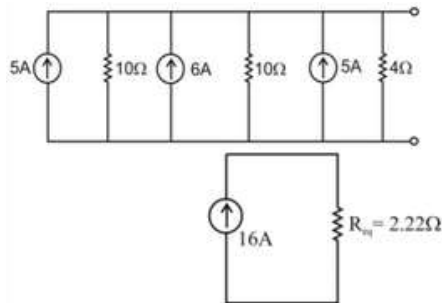
260. Determine the percentage (in %) of maximum power delivered to the load resistance, when $R_L = 3R_{TH}$
(a) 50
(b) 65
(c) 70
(d) 75* (SSC JE 2018)

Hint: $P_{max} = \dfrac{E^2}{4R_L}$

$$P_{max1} = \frac{E_{th}^{\ 2}}{4R_i}$$

$$P_{max2} = \frac{E_{th}^2 R_L}{(R_i + R_L)^2} = \frac{E_{th}^2 (3R_i)}{(R_i + 3R_i)^2}$$

Find ratio.

261. When a source is delivering maximum power to a load, the efficiency of the circuit___:
(a) is always 50%
(b) depends on the circuit parameters*
(c) is always 75%
(d) None of these (SSC JE 2017)

262. The Thevenin and Norton equivalent circuits of a D.C network are shown in Figure.
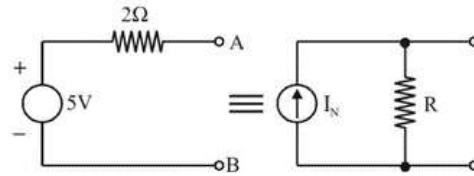
The values of current I and resistance R in the Norton equivalent are:
(a) 2.5A, 2Ω*
(b) 2.5A, 0.5Ω
(c) –2.5A, 2Ω
(d) –2.5A, 0.5Ω (SSC JE 2017)
Hint:
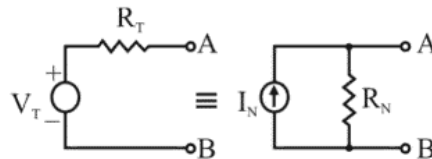
$I_N = V_{th}/R_{th}$ and $R_N = R_{th}$

263. Which of the following is essential for the reciprocity theorem to be applicable?
(a) Linearity
(b) Bilateralism
(c) No initial history
(d) All options are correct*
(SSC JE 01.03.2017)

264. Using superposition theorem, find Vx in the following circuit.
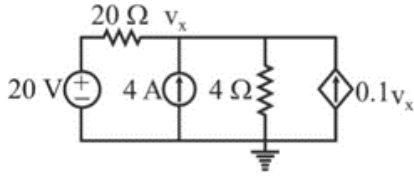
(a) 20 V
(b) 30 V
(c) 15 V
(d) 25 V* (SSC JE 2020)
Hint:
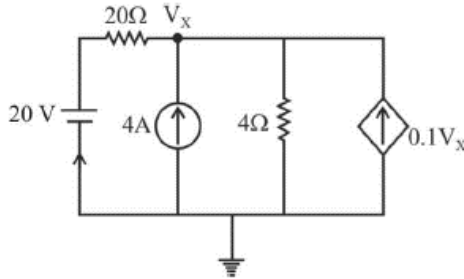
When supply by only 20V then current source is open circuit
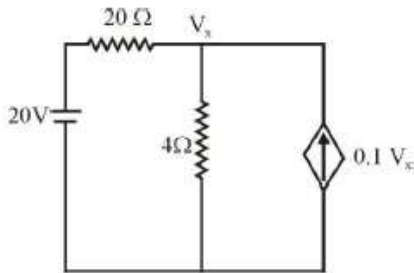
KCL at node V_x

$$\frac{V_x - 20}{20} + \frac{V_x}{4} = 0.1V_x$$

$V_x = 5$ V

When supply by only 4 A source then voltage source is short circuit
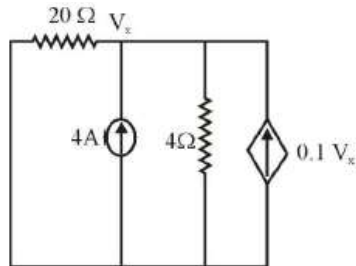
Apply KCL at node V_x

$$\frac{V_x}{20} - 4 + \frac{V_x}{4} - 0.1V_x = 0$$

$V_x = 20$ V
Apply superposition theorem
Net response = algebraic sum of all individual response

Net $V_x = 5 + 20 = 25$V

265. The condition for maximum power transfer is _____ and amount of maximum power is _____.
(a) $R_L = 4R_{th}$, V_{th}^2/R_{th}
(b) $R_L = R_{th}$, V_{th}^2/R_{th}
(c) $R_L = 4R_{th}$, $V_{th}^2/4R_{th}$
(d) $R_L = R_{th}$, $V_{th}^2/4R_{th}$* (SSC JE 2018)

266. Determine the value of current l (in A) through the load resistance for the given electrical circuit:
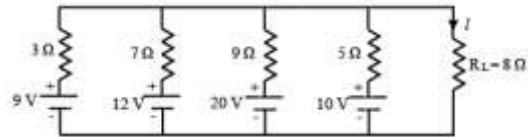
(a) 0.33
(b) 0.85
(c) 1.21*
(d) 2.54 (SSC JE 2018)
Hint:

$$E_m = \frac{\dfrac{E}{R_1} + \dfrac{E_2}{R_2} + ... \dfrac{E_n}{R_n}}{\dfrac{1}{R_1} + \dfrac{1}{R_2} + ... \dfrac{1}{R_n}}$$

$$R_{th} = \frac{1}{\dfrac{1}{R_1} + \dfrac{1}{R_2} + ... \dfrac{1}{R_n}}$$

$$I = \frac{E_m}{R_{th} + R_L}$$

267. Which one of the following is applicable to any network linear or non-linear, active or passive, time varying or invariant as long as Kirchhoff's laws are not violated?
(a) Tellegen's theorem*
(b) Reciprocity theorem
(c) Maximum power transfer theorem
(d) Superposition theorem (SSC JE 2017)

268. A network has two AC sources of different frequencies. Which method of analysis can be used to find current and voltage of different branches ?
(a) Kirchhoff's Law
(b) Superposition theorem*

(c) Thevenin's theorem
(d) Tellegen's theorem (DMRC 2012)

269. When analyzing two port network in cascade, which of the following is more convenient to use ?
(a) z-parameters
(b) h-parameters
(c) T-parameters*
(d) y-parameters (DMRC 2012)

270. How can Thevenin's impedance and Norton's impedance be correlated in a AC circuit ?
(a) Always the same*
(b) Generally the same
(c) Sometimes the same
(d) Always different (DMRC 2012)

271. What is Thevenin's equivalent of an AC network generally ?
(a) Resistance
(b) R and L in series
(c) R and C in series
(d) Either R and L in series or R and C in series* (DMRC 2012)

272. For the given circuit shown, the current supplied by the battery is:
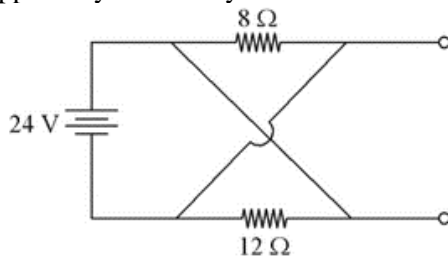
(a) 5 A*
(b) 3 A
(c) 1.2 A
(d) 2 A (DMRC 2017)

273. For the circuit shown find I:
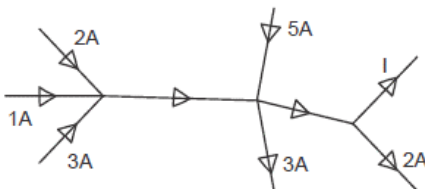
(a) 3 A
(b) 0 A

(c) 6 A*
(d) 1 A (DMRC 2017)

274. According to Kirchhoff's law, the algebraic sum of all IR drops and emf in any closed loop of a network is always:
(a) One
(b) Zero
(c) Positive
(d) Negative* (DMRC 2018)

275. An ideal voltage source is one which has:
(a) zero internal resistance*
(b) infinite internal resistance
(c) very high internal resistance
(d) very low internal resistance (DMRC 2018)

276. Find the current flowing through the 6 Ω resistor in the above figure.
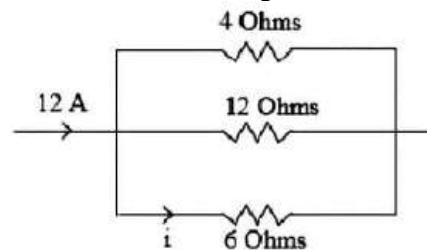
(a) 2A
(b) 4 A*
(c) 6 A
(d) 5 A (DMRC 2018)

277. Estimate the resistance of the filament of a 50 W, 100 V bulb.
(a) 200 Ω*
(b) 50 Ω
(c) 150 Ω
(d) 100 Ω (DMRC 2018)
Hint: $P = V^2/R$

278. Maximum power transfer from source to load occurs when the load resistance is the internal resistance of the circuit.
(a) more than
(b) double
(c) less than
(d) equal to* (DMRC 2018)

279. All energy source forces a constant current of 2 A for 10 s to flow through a lightbulb. If 2.3 kJ is given off in the form of light and heat energy, calculate the voltage drop across the bulb.
(a) 260 V
(b) 130 V
(c) 230 V
(d) 115 V* (DMRC 2020)

Hint: $V = \dfrac{\Delta W}{\Delta q} = \dfrac{\Delta W}{I \Delta t}$

280. How much energy does a 100 W electric bulb consume in two hours?
(a) 720 kJ*
(b) 72 kJ
(c) 720 J
(d) 7200 J (DMRC 2020)
Hint: Energy = p (in W) × t(in sec) J

281. For the circuit shown here, find the current through 8 Q resistor.
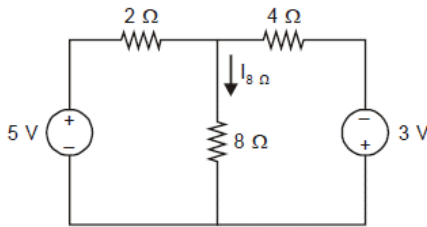
(a) 0.75 A
(b) 0.25 A*
(c) 0.50 A
(d) 0.10 A (DMRC 2020)

282. Find the resistance in the following circuit.
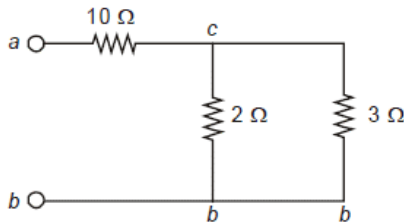
(a) 5.6 Ω
(b) 21 Ω
(c) 15 Ω
(d) 11.2 Ω* (DMRC 2020)

QUESTIONS FROM ESE EXAMS

283. A voltage source-series resistance combination is equivalent to a current source-parallel resistance combination if and only if their
1. Respective open-circuit voltages are equal.
2. Respective short-circuit current are equal.
3. Resistance remains same in both cases.
Which of the above statements are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2 and 3* (ESE 2020)
Hint: See figure.
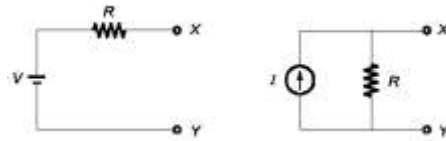
284. For a network graph having its fundamental loop matrix B_f and its sub-matrices B_t and B_l corresponding to twigs and links, which of the following statements are correct?
1. B_l is always an identity matrix.
2. B_t is an identity matrix.
3. B_f has a rank of b − (n − 1), where b is the number of branches and n is the number of nodes of the graph.
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only*
(d) 1, 2 and 3 (ESE 2020)

285. The resistance R of a conductor is
(a) EA/Jl
(b) EJ/Al
(c) EI/JA*
(d) JA/El (ESE 2020)
Where:
E = Electrical field intensity
A = Cross-sectional area
J = Current density
l = Length of conductor
Hint: $J = \sigma E = (1/\rho)E$
∴ $\rho = E/J$
∴ $\rho(l/A) = (E/J)(l/A)$

As R = ρl/A
∴ R = El/JA

286. Which of the following statements are correct for an ideal constant voltage source?
1. Its output voltage remains absolutely constant whatever the change in load current.
2. It possesses zero internal resistance so that internal voltage drop in the source is zero.
3. Output voltage provided by the source would remain constant irrespective of the amount of current drawn from it.
4. Output voltage provided by the source varies with the amount of current drawn from
it.
(a) 1, 2 and 4 only
(b) 1, 3 and 4 only
(c) 2, 3 and 4 only
(d) 1, 2 and 3 only* (ESE 2020)
Hint: See figure.

(Ideal voltage source)
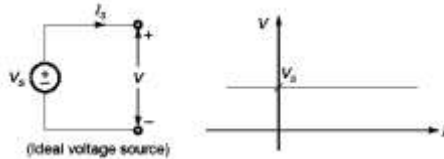
287. Which of the following statements are correct?
1. A lowpass filter passes low frequencies and stops high frequencies.
2. A highpass filter passes high frequencies and rejects low frequencies.
3. A bandpass filter passes frequencies within a frequency band and attenuates frequencies outside the band.
4. A bandstop filter passes frequencies within the band and blocks/attenuates frequencies outside a frequency band.
(a) 1, 2 and 4 only
(b) 1, 3 and 4 only
(c) 2, 3 and 4 only
(d) 1, 2 and 3 only* (ESE 2020)

288. A coil resistance 30 Ω and inductance 0.6 H is switched on to a 240 V supply.
What

are the rate of change of current at the instant of closing the switch at t = 0 and the magnitude of the final steady state current respectively?
(a) 80 A/sec and 80 A
(b) 400 A/sec and 8 A*
(c) 8 A/sec and 80 A
(d) 400 A/sec and 80 A (ESE 2021)
Hint: See figure.
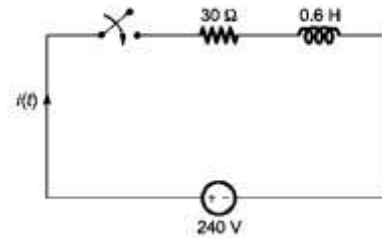
$$240 = 30i(t) + 0.6\frac{di(t)}{dt}$$

t = 0⁺, i(0⁺) = 0 A

$$240 = 30i(0^+) + 0.6\frac{di(0^+)}{dt}$$

∴ di(0⁺)/dt = 400 A
At steady state inductor acts as a short circuit.
$$i(\infty) = V / R = 240 / 30 = 8A$$

289. A current of 10 A flows in a circuit with a 30° angle of lag when the applied voltage
is 100 V. What are the values of resistance and reactance in the circuit respectively?
(a) 8.66 Ω and 5 Ω*
(b) 5 Ω and 8.66 Ω
(c) 6.66 Ω and 4 Ω
(d) 4 Ω and 6.66 Ω (ESE 2021)
Hint: $Z = \frac{V}{I} = \frac{100}{10\angle -30^0} = 10\angle 30^0$
$= 10\cos 30^0 + j10\sin 30^0 = (8.66 + j5)\Omega$

290. Consider the following statements regarding reciprocity theorem:
1. In any passive linear bilateral network, if the single voltage source V_x in branch x produces the current response I_y in branch y, then the removal of the voltage source from branch x and its insertion in branch y will produce the current response I_y in branch x.

2. The interchange of an ideal voltage source and an ideal ammeter in any passive, linear, bilateral circuit will not change the ammeter reading.
3. The interchange of an ideal current source and an ideal voltmeter in any passive linear bilateral circuit will change the voltmeter reading. Which of the above statements are correct?
(a) 1 and 3 only
(b) 1 and 2 only*
(c) 2 and 3 only
(d) 1, 2 and 3 (ESE 2021)

6. What is the value of V_0 in the given circuit?
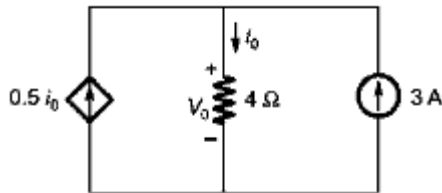
(a) 12 V
(b) 6 V
(c) 24 V*
(d) 15 V (ESE 2021)
Hint: Apply KCL,
$3 + 0.5i_o = i_0$
$i_0 = 6$ A
$V_o = 6 \times 4 = 24$ V

291. A network has 8 branches and 4 independent loops. How many nodes are there in the network?
(a) 11
(b) 13
(c) 5*
(d) 3 (ESE 2021)
Hint: No. of links = b - n + 1
$4 = 8 - n + 1$

292. Three light bulbs are connected to a 9 V battery as shown in the figure. What are the
values of the resistance of 20 W, 15 W, 10 W bulbs respectively?
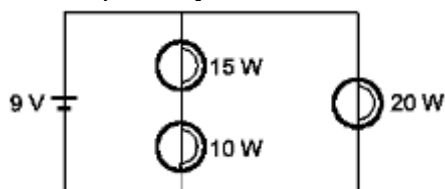
(a) 4.05 Ω, 1.945 Ω, 1.297 Ω*
(c) 7.672 Ω, 4.887 Ω, 4.223 Ω
(b) 6.02 Ω, 3.762 Ω, 3.162 Ω
(d) 8.345 Ω, 6.893 Ω, 5.634 Ω (ESE 2021)
Hint: $P_{20} = V^2/R_{20}$
$R_{20} = 9^2/20 = 4.05$ Ω
Power in first branch = 25 W
Total resistance of first branch = 9 x 9/25
= 3.24 Ω
Current through first branch
$I = 9/3.24 = 2.777$ A
$P_{15W} = I^2 R_{15}$
$15 = 2.777^2 R_{15} \Longrightarrow R_{15} = 1.945$ Ω
Similarly, $10 = 2.777^2 \times R_{10}$
Giving $R_{10} = 1.297$ Ω

293. For the circuit in figure, the values of i_1 and i_4 are respectively,
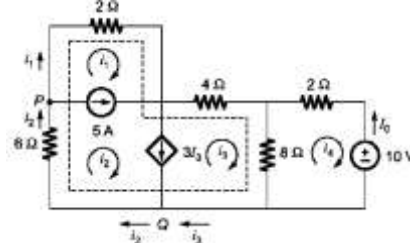
(a) -7.5 A, 2.143 A*
(c) 3.4 A, -6.5 A
(b) -2.5 A, 3.93 A
(d) 7.1 A, -3.4 A (ESE 2021)
Hint: Write KVL in 4th loop
$10i_4 - 8i_3 = -I_0$ (1)
Substitute
$i_4 = -I_0$ in eq. (1)
$10 \times I_0 + 8i_3 = 10$
$I_0 = 1 - 0.8i_3$
Write KVL equation for 3 loops at a time
$2i_1 + 6i_2 + 12i_3 - 8i_4 = 0$
$i_4 = -I_0$
$2i_1 + 6i_2 + 12i_3 + 8I_0 = 0$ (2)
Substitute I_0 value in eqn. (2)
$2i_1 + 6i_2 + 5.6i_3 = -8$ (3)
$i_2 - i_1 = 5$ (4)
$i_2 - i_3 = 3I_0$ (5)
Sub. I_0 value in eq. (5)
$i_2 - i_3 = 3(1 - 0.8i_3)$
$i_2 + 1.4i_3 = 3$ (6)
Solve eq. (3), (4) and (6),
$i_1 = -7.5$ A,
$i_3 = 3.928$ A
$I_0 = -2.143$ A

$i_4 = 2.143$ A

294. An energy source forces a constant current of 2 A for 10 s to flow through a light bulb. If 2.3 kJ is given off in the form of light and heat energy, what is the voltage drop across the bulb?
(a) 120 V
(b)| 115 V*
(c) 110 V
(d) 105 V (ESE 2021)
Hint: H= I^2Rt
2.3 x 10^3 = 2^2 x R x 10
R = 57.5 Ω and V=IR = 115 V

295. What is the input impedance of the circuit, if the circuit operates at ω = 50 rad/s?
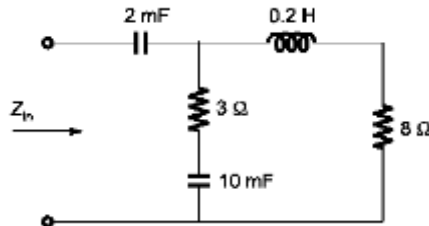
(a) (5.63 - j5.94) Ω
(b) (3.22 - j11.07) Ω*
(c) (4.54 + j6.79) Ω
(d) (6.86 + j13.54) Ω (ESE 2021)
Hint: See figure.
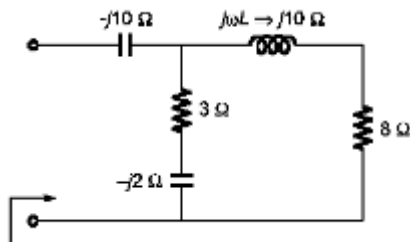
$$Z_{in} = \frac{(8+ j10)(3- j2)}{(8+ j10+3- j2)} - j10$$
$$= (3.22 - j11.07)\Omega$$

296. The Thevenin voltage and resistance across the terminal a-b of the circuit in the figure respectively are
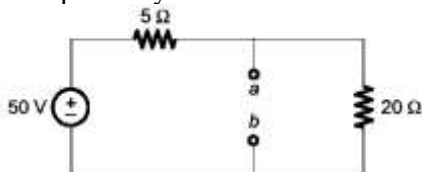
(a) 40 V, 4 Ω*
(b) 20 V, 8 Ω
(c) 40 V, 8 Ω
(d) 20 V, 4 Ω (ESE 2022)
Hint: Case 1: V_{th}
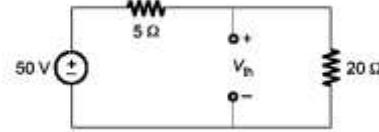
$$V_{th} = 50x\frac{20}{20+5} = 40V$$

Case 2: R_{th}
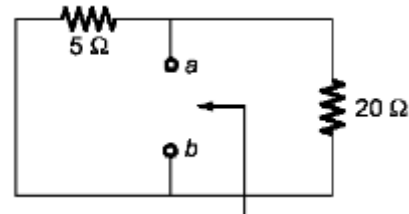
$$R_{th} = \frac{5x20}{5+20} = 4\Omega$$

297. What is C_{eq} for the given circuit?
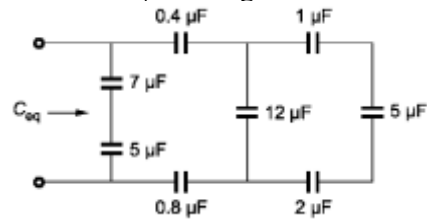
(a) 6.18 µF
(b) 3.18 µF*
(c) 8.23 µF
(d) 12.67 µF (ESE 2022)
Hint: Simplify circuit.
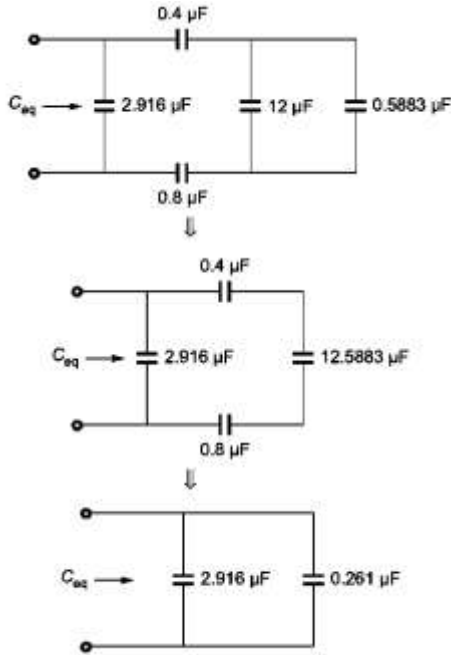
$C_{eq} = 3.177\ \mu F = 3.18\ \mu F$

298. Consider the following statements with respect to Kirchhoff's laws for a circuit comprising of resistances and independent sources:

1. The number of independent element volt-ampere equations is equal to the number of resistances.
2. The number of independent KVL equations is equal to one more than the number of nodes.
3. The number of independent KVL equations is equal to the number of independent loops.

Which of the above statements is /are not correct?

(a) 1 only
(b) 2 only*
(c) 2 and 3 only
(d) 1, 2 and 3 (ESE 2022)

299. What is the voltage v in the circuit diagram?
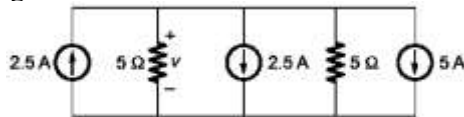
(a) 7.5 V
(b) 16.5 V
(c) 12.5 V*

(d) 14.4 V (ESE 2022)
Hint: A simplified circuit is given below.
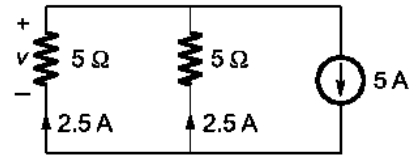
V = -2.5 X 5 = -12.5
|v| = 12.5

300. When angular frequency for d.c. sources is zero, capacitor and inductor will act like
respectively
(a) short circuited, open circuited
(b) open circuited, short circuited*
(c) open circuited, open circuited
(d) short circuited, short circuited (ESE 2022)

Hint: When angular frequency is zero, $\omega = 0 \Rightarrow X_L = \omega L = 0$ or inductor behaves as short circuit.
Similarly,
$X_C = 1/\omega C = 1/0 = \infty$
The capacitor behaves as open circuit.

301. What are the unknown currents i_5 and i_3 respectively for the circuit shown in the figure below?
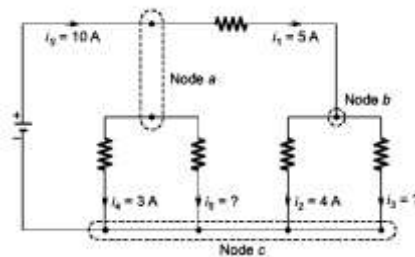
(a) 2 A and 1 A*
(b) 1 A and 2 A
(c) 18 A and 9 A
(d) 9 A and 18 A (ESE 2023)
Hint: $i_5 = 10$ A
$i_1 = 5$ A
$i_2 + i_3 = 5$ A
$i_3 = 5 - i_2 = 5 - 4 = 1$ A
$i_4 + i_5 = 5$
$i_5 = 5 - 3 = 2$ A

302. What is the current delivered by the 10 V source in the circuit shown below?
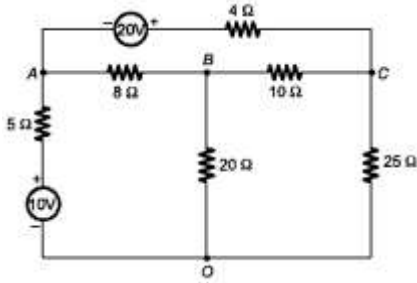
(a) 2.132 A
(b) 3.132 a
(c) 1.132 A*
(d) 0.532 A (ESE 2023)
Hint: See figure.
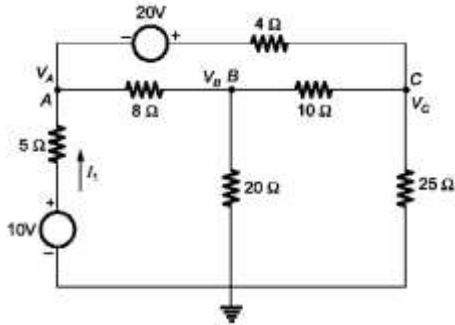
KCL at node A
$$\frac{V_A - 10}{5} + \frac{V_A - V_B}{8} + \frac{V_A + 20 - V_C}{4} = 0$$

$$\frac{23}{40}V_A - \frac{V_B}{8} - \frac{V_C}{4} = -3 \qquad (1)$$

KCL at B
$$\frac{V_B - V_C}{10} + \frac{V_B}{20} + \frac{V_B - V_A}{8} = 0$$

$$\frac{-V_A}{8} + \frac{11}{40}V_B - \frac{V_C}{10} = 0 \qquad (2)$$

KCL at node C
$$\frac{V_C}{25} + \frac{V_C - V_B}{10} + \frac{V_C - 20 - V_A}{4} = 0$$

$$\frac{-V_A}{4} + \frac{-V_B}{10} + \frac{39}{100}V_B = 5 \qquad (3)$$

Solve these equations.
$V_A = 4.34$ V
$I_1 = (10 - V_A)/5$

303. The following circuit shown in the figure has a voltage source and a dependent current source. What is the Thevenin equivalent resistance at terminals a - b?
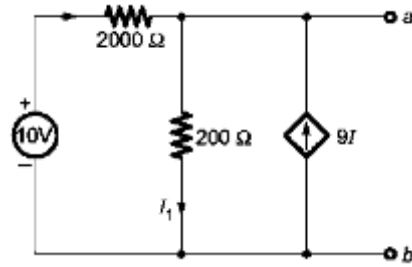
(a) 10 Ω
(b) 20 Ω
(c) 100 Ω*
(d) 200 Ω (ESE 2023)
Hint: See figure.
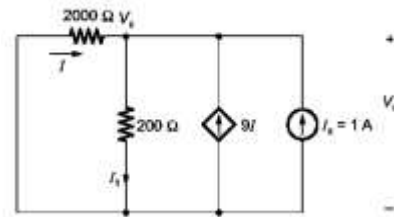
Hint: $V_s = 200(I_1) = 200(I + 9I + 1)$
$\therefore V_s = 200(10I + 1) \qquad (1)$
Also $V_s = -2000I \qquad (2)$
Solving I = -0.05 A
$$R_{th} = \frac{V_s}{I_s} = \frac{-2000(-0.05)}{1} = 100\Omega$$

304. An experimental circuit as shown in the figure below has the variable resistor RL which is adjusted to the value of the load resistor as 10 Ω. What is the maximum load power?
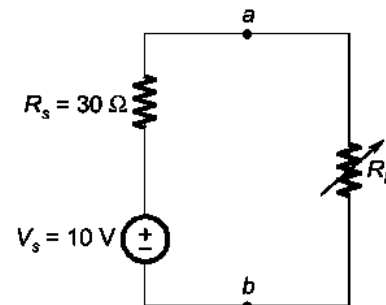
(a) 981 mW
(b) 816 mW
(c) 733 mW
(d) 625 mW* (ESE 2023)
Hint: $I_L = \dfrac{V}{R_S + R_L} = \dfrac{10}{30 + 10} = 0.25A$

$$P = I_L^2 R_L = \left(\frac{1}{4}\right)^2 x10 = 625mW$$

305. In the circuit of the figure shown below, the source voltage is 100 V, the resistance is 10 kΩ, and the capacitance is 0.005 μF. In how much time can the capacitor voltage be discharged to 5 V after the switch is turned to position 3?
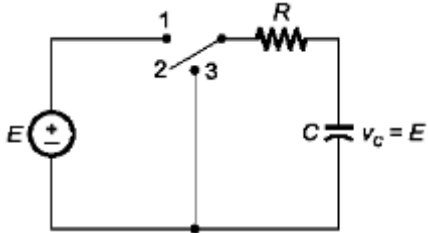
(a) 50 μs
(c) 150 ms
(b) 50 ms
(d) 150 μs* (ESE 2023)
Hint: The initial voltage, $V_C = 100$ V
Time constant,
$\tau = RC = 10 \times 10^3 \times 0.005 \times 10^{-6} = 50$ μsec
The final voltage, $V(t_0) = 5$ V
The % change in voltage = $(100 - 5)/5$
$t_0 = 3\tau = 3 \times 50 = 150$ μsec

306. What is the value of V_A8 in the network shown in the figure?
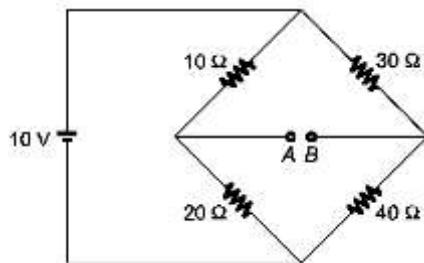
(a) 0.86 V
(b) 0.96 V*
(c) 0.66 V
(d) 0.76 V (ESE 2024)
Hint: $V_{AB} = V_A - V_B$
= 10(20/30) – 10(40/70) = 0.96 V

307. Five resistances of 10 Ω each are connected between terminals A and 8 as shown in the figure. What is the total resistance between terminals A and B?

(a) 5 Ω
(b) 10 Ω
(c) 15 Ω
(d) 20 Ω (ESE 2024)
Hint: See figure.
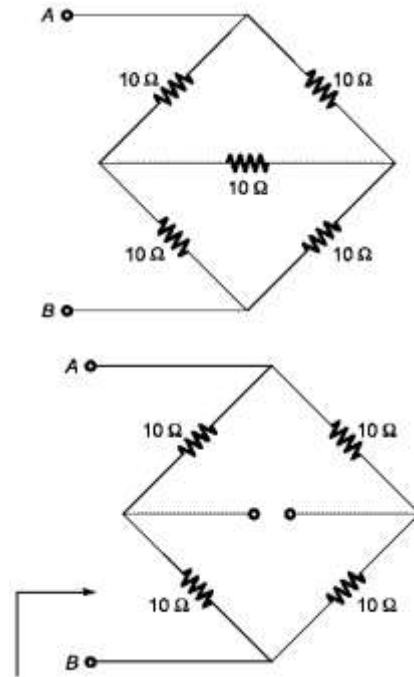
308. The Thevenin equivalent circuit voltage and resistance for the given circuit between terminals a and b respectively
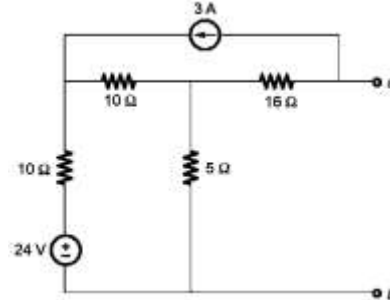
(a) 49.2 V, 10 Ω
(b) -49.2 V, 15 Ω
(c) -49.2 V, 20 Ω*
(d) 49.2 V, 20 Ω (ESE 2024)
Hint: Applying KVL in loop 1
$24 = 25I_1 + 30$
$I_1 = -6/24$ A
$V_{th} = 5I_1 - 48 = 5(-6/24) - 48 = -49.2$ V
$R_{th} = [(10 + 10) \| 5] + 16 = 20$ Ω

309. What is the maximum power that can be delivered to the variable resistor R in the circuit?
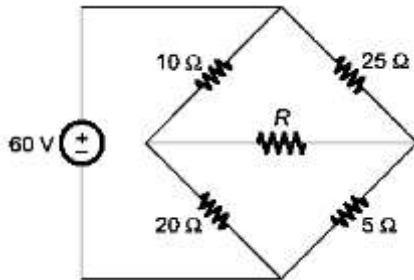
(a) 15.77 W
(b) 18.77 W
(c) 19.77 W
(d) 20.77 W* (ESE 2024)
Hint: See figure.
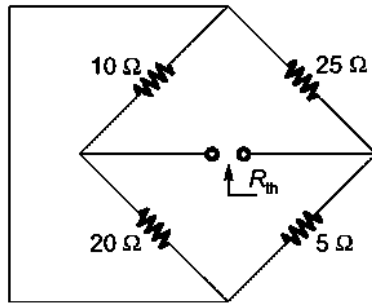
Condition for maximum power transfer is
For R_{th} calculation,
$R_{th} = (10 \parallel 20) + (25 \parallel 5) = 325/30\ \Omega$
For V_{th} calculation,

$$V_{th} = 60x\frac{20}{30} - 60x\frac{5}{30} = 30V$$

$$P_{max} = \frac{V_{th}^2}{4R_{th}} = \frac{30x30}{4(325/30)} = 20.7W$$

310. Consider the following statements regarding the initial conditions for inductor and capacitor :
1. If there is no current flowing through the inductor at $t = 0^-$, the inductor will act as an open circuit at $t = 0^+$.
2. If there is no voltage across the capacitor at $t = 0^-$, the capacitor will act as an open circuit at $t = 0^+$.
3. If a current of value I_0 flows through the inductor at $t = 0^-$, the inductor can be regarded as a current source of I_0 ampere at $t = 0^+$.

Which of the above statements is/are correct?
(a) 1 only
(b) 2 only
(c) 1 and 3 only*
(d) 1, 2 and 3 (ESE 2024)

311. What is the value of voltage V0 shown in the circuit?
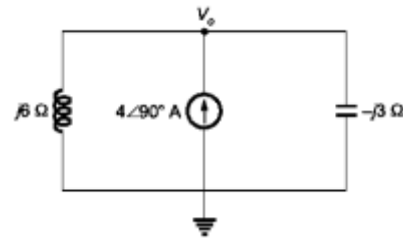
(a) -8 V
(b) 8 V
(c) 24 V*
(d) -24 V (ESE 2024)
Hint: Applying KCL

$$\frac{V_0}{j6} + \frac{V_0}{-j3} = 4\angle 90^0$$

$$V_0\left[\frac{1}{j6} + \frac{1}{-j3}\right] = j4$$

$\therefore V_0 = 24$ V

312. The Z parameters of a two-port network are $Z_{11} = 20\ \Omega$, $Z_{22} = 30\ \Omega$, $Z_{12} = Z_{21} = 10$
Ω. The corresponding values of ABCD parameters are

(a) $\begin{bmatrix} 2 & 0.1 \\ 50 & 3 \end{bmatrix}$

(b) $\begin{bmatrix} 3 & 50 \\ 0.1 & 2 \end{bmatrix}$

(c) $\begin{bmatrix} 2 & 40 \\ 0.1 & 3 \end{bmatrix}$

(d) $\begin{bmatrix} 2 & 50 \\ 0.1 & 3 \end{bmatrix}$* (ESE 2024)

Hint: $V_1 = 20I_1 + 10I_2$ (1)
$V_2 = 10I_1 + 30I_2$ (2)
$V_1 = AV_2 - 8I_2$
$I_1 = CV_2 - DI_2$
From eq 2

$$I_1 = \frac{V_2}{10} - \frac{30}{10}I_2 \qquad (3)$$

Substitute (3) in eq 1

$$V_1 = 20\left(\frac{V_2}{10} - 3I_2\right) + 10I_2$$

$$V_1 = 2V_2 - 50I_2 \qquad (4)$$

From eqn. (3) and eqn. (4), ABCD

parameters are: $\begin{bmatrix} 2 & 50 \\ 0.1 & 3 \end{bmatrix}$

313. What is the value of equivalent inductance of the network shown in the figure?
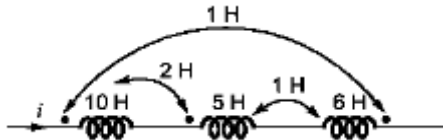
(a) 19 H
(b) 21 H*
(c) 23 H
(d) 25 H (ESE 2024)

Hint: $L_{eq} = L_1 + L_2 + L_3 + 2M_{12} - 2M_{23} - 2M_{13} = 10 + 5 + 6 + 2(2) - 2(1) - 2(1) = 21H$

314. An initially uncharged 1 mF capacitor has the current shown in the figure. What is the voltage across it at t = 2 ms?
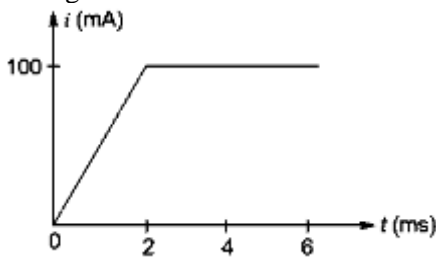
(a) 50 mV
(b) 100 mV*
(c) 200 mV
(d) 250 mV (ESE 2024)

Hint: $i(t) = \frac{100 \times 10^{-3}t}{2x10^{-3}} = 50t; 0 < t \le 2$

$$V_c(t) = \frac{1}{C}\int_0^{2x10^{-3}} i(t)dt = \frac{1}{1x10^{-3}}\int_0^{2x10^{-3}} 50t\,dt$$

QUESTIONS FROM GATE EXAMS

315. The Thevenin equivalent voltage, VTH, in V (rounded off to 2 decimal places) of the network shown below, is _____ .
(GATE 2020)
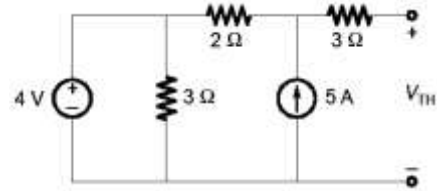
Hint: See figure.
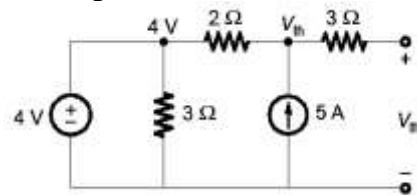
$(V_{th} - 4)/2 = 5$
$\therefore V_{th} = 14$ V

316. A resistor and a capacitor are connected in series to a 10 V dc supply through a switch. The switch is closed at t = 0, and the capacitor voltage is found to cross 0 V at t = 0.4τ, where τ is the circuit time constant. The absolute value of percentage change required in the initial capacitor voltage if the zero crossing has to happen at t = 0.2τ is

_____ (rounded off to 2 decimal places).
(GATE 2020)
Hint: If initial charge polarities on the capacitor is opposite to the supply voltage then only the capacitor voltage crosses the zero line.
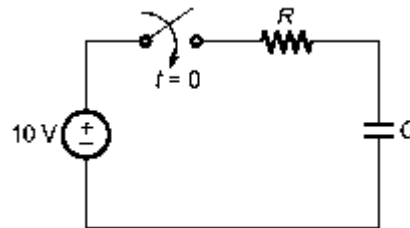
$V_c(t)$ implies final value + (initial value – final value)$e^{-t/\tau}$.
$0 = 10 + (-V_0 - 10)e^{-0.4}$
$V_0 = 4.918$ V
$t = 0.2\tau$
$0 = 10 + (-V_0' - 10)e^{0.2}$
$V_0' = 2.214$

% change in voltage =](4.918 – 2.214)/4.918] x 100 = 54.99%

317. In the circuit, switch 'S' is in the closed position for a very long time. If the switch is opened at time t = 0, then $i_L(t)$ in amperes, for t ≥ 0 is
(a) 10
(b) $8e^{-10t}$
(c) $8 + 2e^{-10t}$*
(d) $10(1 – e^{-2t})$ (GATE 2021)
Hint: At t = 0⁻
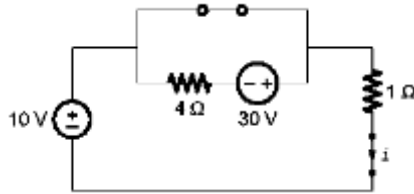
$i_L(0^-) = 10/1 = 10$ A
At t > 0

At t = ∞

$i(\infty) = 40/5 = 8$ A
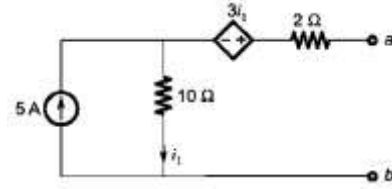

$R_{eq} = 5\ \Omega$
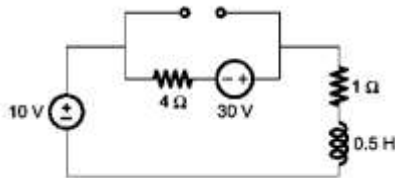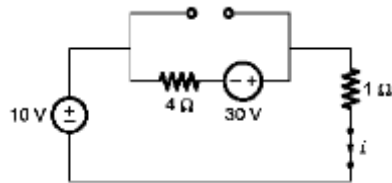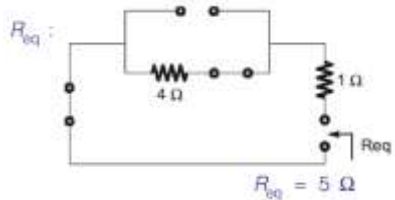
$\tau = L/R_{eq} = 0.5/5 = 0.1$ sec
$i(t) = 8 + [10 – 8]e^{-t/0.1}$

318. For the network shown, the equivalent Thevenin voltage and Thevenin impedance as seen across terminals 'ab' is

(a) 10 V in series with 12Ω
(b) 35 V in series with 2Ω
(c) 50 V in series with 2Ω
(d) 65 V in series with 15Ω (GATE 2021)
Hint: See figure.
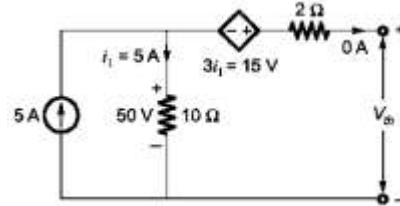
$V_{TH} = 15 + 50 = 65$ V
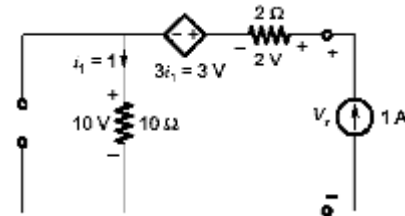
$V_x = 2 + 3 +10 = 15$ V
$R_{th} = V_x/1 = 15\ \Omega$

319. In the given circuit, for voltage VY to be zero, the value of ~ should be ____ (Round off to 2 decimal places). (GATE 2021)
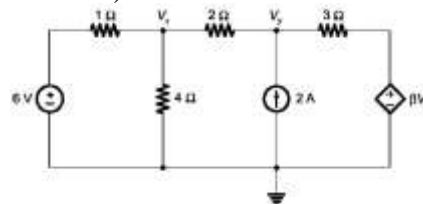
$$\frac{V_x - 6}{1} + \frac{V_x}{4} + \frac{V_x - V_y}{2} = 0$$
If $V_y = 0$ the we get $V_x = 24/7$
Now, $$\frac{V_y - V_x}{2} + \frac{V_y - \beta V_x}{3} = 2$$
Putting $V_y = 0$, $\beta = -3.25$

320. The input impedance z;n(s), for the network shown in
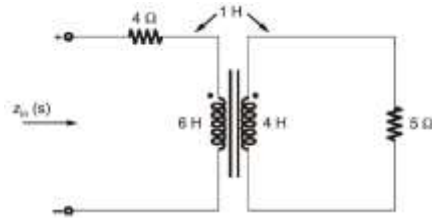
(a) $7s + 4$

(b) $\dfrac{23s^2 + 46s + 20}{4s + 5}$

(c) $\dfrac{25s^2 + 46s + 20}{4s + 5}$

(d) $6s + 4$ (GATE 2021)

Hint: Consider circuit in s domain.
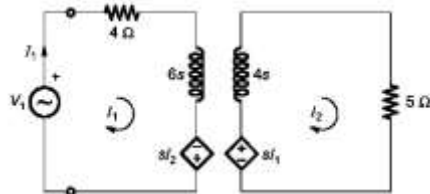
$-sI_1 + (4s + 5)I_2 = 0$

$I_2 = \dfrac{s}{4s + 5}I_1$

$V_1 = (4 + 6s)I_1 - \dfrac{s^2}{4s + 5}I_1$

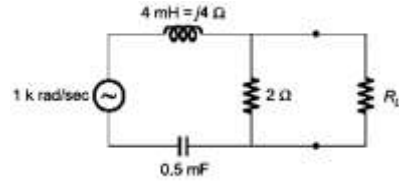$\dfrac{V_1}{I_1} = \dfrac{(4 + 6s)(4s + 5) - s^2}{4s + 5}$

$= \dfrac{24s^2 + 30s + 16s + 20 - s^2}{4s + 5}$

$Z_{in} = \dfrac{23s^2 + 46s + 20}{4s + 5}$

321. In the given circuit, for maximum power to be delivered to R_L, its value should be _____ Ω, (Round off to 2 decimal places). (GATE 2021)

Hint: See figure.

$= \dfrac{-j}{\omega C} = \dfrac{-j}{1000 x 0.5 x 10^{-3}} = -j2\Omega$

$Z_{in} = 2 \| j2 = \dfrac{j4}{2 + j2} = \dfrac{j2}{1 + j1}$

For maximum power

$R_L = | Z_{th} | = \dfrac{2}{\sqrt{2}} = \sqrt{2} = 1.414\Omega$

322. In the given circuit, the value of capacitor C that makes current I= 0 is ___ μF. (GATE 2021)
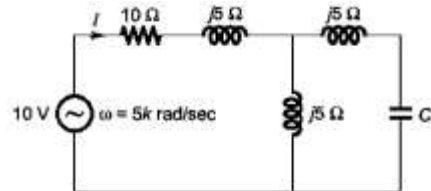
Hint: See figures.
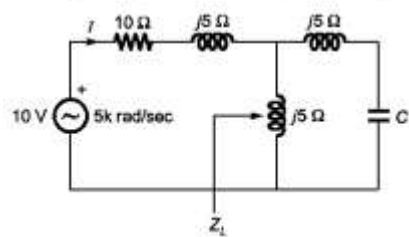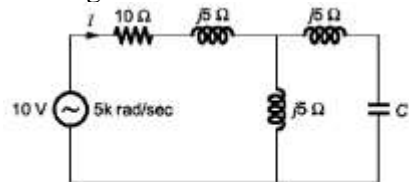
$Z_L = (j5) \| (j5 - jX_C)$

$\dfrac{(j5)(j5 - jX_C)}{j5 + j5 - jX_C} = \infty$

j5 + j5 -jX_C = 0

From this, $X_C = 10\Omega$
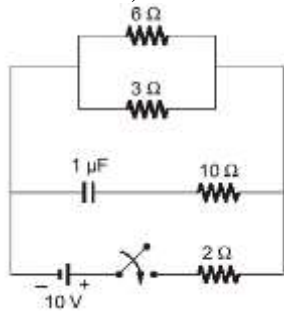
$X_C = 10 = 1/\omega C \Rightarrow C = 20 \mu F$

323. The network shown below has a resonant frequency of 150 kHz and a

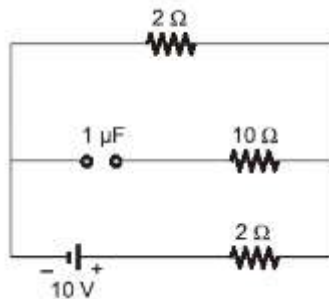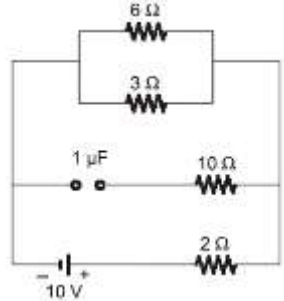bandwidth of 600 Hz. The 0-factor of the network is ___ . (round off to nearest integer). (GATE 2022)
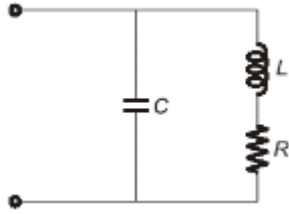
Hint: $Q = f_0/BW$

324. In the circuit shown below, the switch S is closed at $t = 0$. The magnitude of the steady state voltage, in volts, across the 6Ω resistor is ___ . (round off to two decimal places). (GATE 2022)

Hint: In steady state capacitor acts as an open circuit for DC supply.

The voltage across 6Ω is

$$V_0 = 10x\frac{2}{(2+2)} = 5\Omega$$

325. Consider the system as shown below: x(t) where y(t) = x(e^t).

The system is
(a) linear and causal.
(b) linear and non-causal*
(c) non-linear and causal
(d) non-linear and non-causal (GATE 2022)
Hint: The given system will satisfy law of superposition. So the system will be *linear*.
Now, y(t) = x(e^t)
Put, t = 0,
y(0) = x(1)
Since output is depending on future value of input. So the system is *non-causal*.

326. The value of parameters of the circuit shown in the figure are:
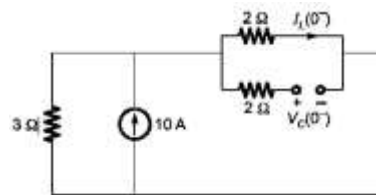$R_1 = 2\ \Omega$, $R_2 = 2\ \Omega$, $R_3 = 3\ \Omega$
$L = 10$ mH
$C = 100\ \mu F$
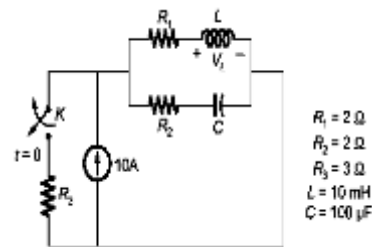
For time $t < 0$, the circuit is at steady state with the switch 'K in closed condition. If the switch is opened at $t = 0$, the value of the voltage across the inductor (V_L) at $t = 0^+$ in volts is _____ (Round off to 1 decimal place). (GATE 2023)
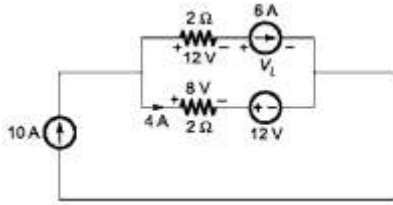Hint: For $t = 0^-$

$$I_L(0^-) = 10x\frac{3}{(3+2)} = 6A$$

$$V_C(0^-) = 6x2 = 12V$$

For $t = 0^+$

$20 = 12 + V_L$
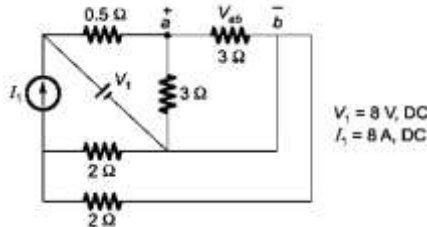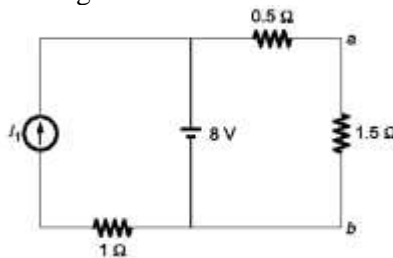$V_L = 8$ V

327. For the circuit shown in the figure, V_1 = 8 V, DC and I_1 = 8 A, DC. The voltage V_{ab} in Volts is ____ (Round off to 1 decimal place). (GATE 2023)
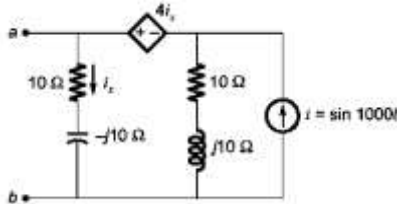

Hint: See figure.
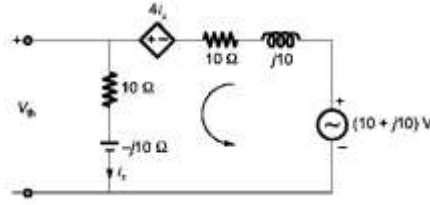

By applying voltage division rule, we can get

$$V_{ab} = 8\left(\frac{1.5}{1.5+0.5}\right) = 6V$$

328. For the circuit shown, if i = sin 1000t, the instantaneous value of the Thevenin's equivalent voltage (in Volts) across the terminals a-b at time t = 5 ms is ____ (Round off to 2 decimal places). (GATE 2023)

Applying source transformation

Applying KVL
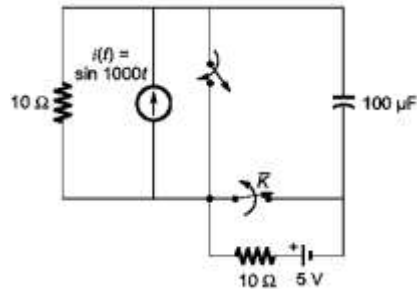$10 + j10 = (10 + j10)i_x - 4i_x + (10 - j10)i_x$
$i_x = (10 + j10)/16$
$V_{th} = i_x(10 - j10)$
$= 0.884\angle45^0$ x $14.142\angle-45^0 = 12.5\angle0^0$ V
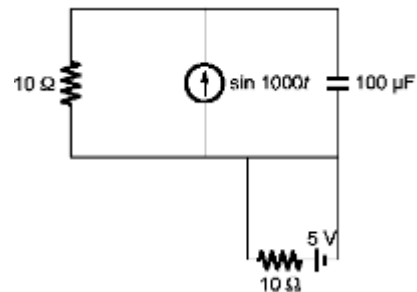$V_{th} = 12.5\sin1000t = 12.5\sin1000$ x 5 x 10^{-3}
$= -11.98$ V

329. The circuit shown in the figure is initially in the steady state with the switch K in open condition and $\bar{K}$ in closed condition.

The switch K is closed and $\bar{K}$ is opened simultaneously at the instant t = t_1, where t_1 > 0. The minimum value of t_1 in milliseconds, such that there is no transient in the voltage across the 100 μF capacitor, is ____ (Round off to 2 decimal places). (GATE 2023)
Hint: t = 0⁻

$$X_C = \frac{1}{\omega C} = \frac{1}{1000 x 100 x 10^{-6}} = 10\Omega$$
$$V_C = 1\angle0^0 x \frac{10}{10 - j10} * (-j10)$$

$$= = \frac{(10)(-j10)}{10 - j10} x \frac{10 + j10}{10 + j10} = 5 - j5$$

$V_C = 7.07\angle - 45^0$

$V_C(t) = 7.07 \sin(1000t - 45^0)$
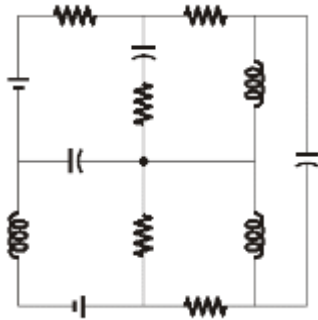
At t = t_1

$V_C(t) = 7.07 \sin(1000t_1 - 45^0)$

$V_C(\infty) = 5V; \tau = RC = 10x100x10^{-6} = 10^{-3}$

$V_C(t) = 5 + [7.07 \sin(1000t_1 - 45) - 5]e^{-(t/10^{-3})}$
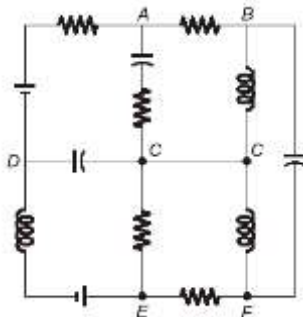
$7.07 \sin(1000t_1 - 45) = 5$

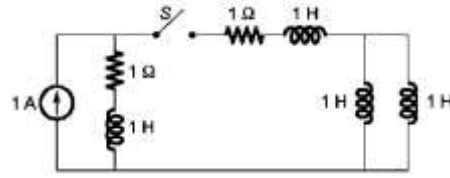From this t_1 = 1.57 msec

330. The number of junctions in the circuit is

(a) 8
(b) 6*
(c) 7
(d) 9 (GATE 2024)
Hint: See figure.

A point at which more than two elements are joints together is called Junction. A, B, C, D, E and F are junction.

331. The circuit shown in the figure with the switch S open, is in steady state. After the switch S is closed, the time constant of the circuit in seconds is
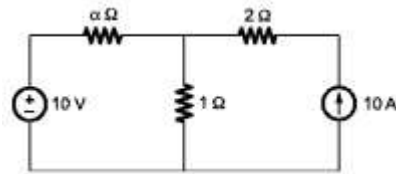

(a) 1.5
(b) 1.25*
(c) 0
(d) 1 (GATE 2024)
Hint: L_{eq}= 1 + 1 + (1||1) = 2.5 H
R_{eq} = 2Ω
$\tau = L_{eq}/R_{eq}$

332. All the elements in the circuit are ideal. The power delivered by the 10 V source in watts is

(a) 100
(b) 0*
(c) dependent on the value of α
(d) 50 (GATE 2024)